

U.S. DEPARTMENT OF LABOR MSHA



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**BUREAU OF MINES: THE FOCAL POINT
FOR FEDERAL TECHNOLOGY
APPLICABLE TO THE MINING
AND MINERAL INDUSTRIES**

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**BUREAU OF MINES: THE FOCAL POINT
FOR FEDERAL TECHNOLOGY
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AND MINERAL INDUSTRIES**

By

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Pittsburgh Research Center**

OFR 38-90

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EXECUTIVE SUMMARY

On March 20, 1989, a meeting was held at the U.S. Bureau of Mines Pittsburgh Research Center at the request of Senator Pete V. Domenici of New Mexico. The purpose of the meeting was to engender a technical relationship between the National Laboratories and the minerals industry. During the meeting, the Director of the Bureau of Mines, T S Ary, suggested that since the Bureau is the focal point for mining research in the United States, it would be appropriate for the agency to act as the liaison between the National Laboratories and the minerals industry. As the first step in this process, the author was selected to perform a 6-month investigation to better define the proper role of the Bureau in this area.

As part of the investigation, the mining and mineral-related technology available at 21 major U.S. Department of Energy (DOE) Research Laboratories was reviewed. It was assumed that the broad range of scientific and technical areas covered by DOE research would provide fertile ground for mining-related technologies. It was hoped that the applicability of DOE research to this liaison effort would be indicative of Federal laboratories in general.

As a direct result of the opportunities for interagency technology transfer identified, a program to improve the Bureau of Mines' performance as the focal point for Federal laboratory technology applicable to the U.S. mining and minerals industry is recommended. To make this program a Bureauwide effort, it should be established within the Bureau's Technology Transfer Office, reporting to the Washington Office. However, the program should be physically located at a large research center and provided with administrative and clerical support. This serves to foster a current knowledge of Bureau research efforts and technology needs. The effort should function as a management information service to the Washington Office and the nine Research Directors. A team of three Bureau professionals knowledgeable in mining systems, metallurgy, and environmental engineering should be the core of this concentrated effort to identify technology transfer opportunities to the U.S. mining and minerals industry, the cooperating Federal laboratory, and the Bureau. Individual researchers, supported by their research center management, would be responsible for forming the industrial and Federal laboratory partnerships necessary to capitalize on the opportunities identified.

INTRODUCTION

On March 20, 1989, a meeting was held at the U.S. Bureau of Mines Pittsburgh Research Center at the request of Senator Pete V. Domenici of New Mexico. The purpose of the meeting was to engender a technical relationship between the National Laboratories and the minerals industry, the ultimate goal being to enhance our Nation's minerals industries through technology transfer. Representatives of government, academia, and the minerals industry attended. During the meeting, the Director of the Bureau of Mines, T S Ary, suggested that since the Bureau is the focal point for mining research in the United States, it would be appropriate for the agency to act as the liaison between the National Laboratories and the minerals industry. This idea was well received by the participants and put into place by a letter to all attendees from the Secretary of the Interior, Manuel Lujan, Jr. In it he stated, "The Bureau of Mines has served effectively as the Federal focal point on technology issues with the mining industry, and I expect them to continue to serve in this capacity. Since

the Bureau has established effective communication mechanisms between the Federal sector and the industry, I would be pleased to have them serve as the interface with the National Laboratories regarding mining issues."

As reflected in comments by T S Ary and Secretary Lujan, interagency technology transfer is fast becoming a major priority for all Federal research laboratories. Deborah L. Wince-Smith, Assistant Secretary for Technology Policy, U.S. Department of Commerce, and Cherri Langenfeld, Acting Director, Office of Technology Policy, U.S. Department of Energy, both expressed interest in and offered support for the "focal point" concept. The Federal focal point concept was defined as an effort by a Federal laboratory, with close ties to a specific industrial base, to assist in the transfer of technology from the Federal laboratory system to that industry. A Bureauwide effort to facilitate the use of technology developed in the Federal laboratory system for the benefit of the U.S. mining and minerals industries would constitute such an endeavor.

R. R. Beebe, Senior Vice President, Homestake Mining Company, San Francisco, CA, put the industry view in perspective in his speech entitled "Prospects For a More Internationally Competitive U.S. Mining Industry" at the May 1990 Capital Metals and Materials Forum in Washington, DC. He said, "One of the most significant problems is the lack of an adequate science and technology base to support mining and processing. There is a need for more people with a foot in each camp who can act as technology transfer agents and communicators."

The author was assigned to perform a 6-month investigation to better define the proper role of the Bureau as the Federal focal point for mining and mineral-related technology developed in the Federal laboratory system. The following tasks were outlined:

1. Develop an overall picture of the National Laboratories research output. Determine the form, volume, and accessibility of available National Laboratory technical information. Acquire reports that summarize National Laboratory research efforts.
2. Visit a number of National Laboratory facilities to obtain first-hand information on current mining-related research and technology transfer efforts. Explore the possibility of a National Laboratory contribution to a Bureau liaison effort.
3. Assess the relevancy of National Laboratory technology to the mining industry and Bureau research. Determine what Bureau effort would be required to put the technology into a form directly usable to the U.S. mining industry. Isolate the impact of the technology on existing Bureau research.
4. Prepare a summary report that details findings and recommends the role of the Bureau as a possible liaison between the National Laboratories and the U.S. mining industry. A detailed implementation plan will be part of the summary report.

METHODOLOGY

The investigation of National Laboratory technology applicable to the mining and minerals industry was limited to the 21 major DOE Research Laboratories located across the country. It was assumed that the broad range of scientific and technical areas covered by DOE research would provide fertile ground for mining-related technologies. It was hoped that the applicability of DOE technology to this effort would be indicative of Federal laboratories in general.

General information was requested on each laboratory from its respective technology transfer office. Contact with the DOE laboratories was initiated by a letter from Dr. David R. Forshey, Associate Director--Research, Bureau of Mines, to each of the 21 laboratory directors. A copy of the letter is contained in appendix A. The letter introduced the "focal point" effort and asked the laboratory director to designate a contact point within his organization to facilitate communication on this issue. A copy of "U.S. Bureau of Mines Research 88--A Summary of Significant Results in Mineral Technology and Economics" was enclosed. This publication gave each laboratory director general information on structure, mission, activities, and accomplishments of the Bureau of Mines. General comments or suggestions on this effort were encouraged.

Each of 20 designated contact individuals, appointed by their DOE laboratory directors, were sent a letter further describing the effort. It was assumed that the Bureau's current research program represented the needs of the mining and mineral industries. A summary of the current Bureau of Mines research program, based on Fiscal Year 1989 Annual Reports from each of the nine Bureau research centers, was attached. An example of the letter and the Bureau summary are contained in appendix A. The summary document proved to be invaluable in this effort, as the majority of the contacts had a very limited knowledge of mining or Bureau activities. The summary was used by the DOE contacts to select technologies appropriate to this "focal point" effort. These technologies were then scheduled for discussion during laboratory visits, which were arranged upon subsequent telephone contact.

Visits of 1 full working day were made to 15 DOE laboratories: Argonne National Laboratory, Brookhaven National Laboratory, Idaho National Engineering Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Battelle Pacific Northwest Laboratories, Ames Laboratory, Fermi National Accelerator Laboratory, Morgantown Energy Technology Center, EG&G Mound Applied Technologies, Oak Ridge Associated Universities, Pittsburgh Energy Technology Center, Princeton Plasma Physics Laboratory, Savannah River Company, and Westinghouse Hanford Company. A report on each visit was prepared. The six laboratories not visited are also represented by a similar, less detailed report. A copy of each report is contained in the appropriate appendix.

The 1-day visit format allowed for only a glimpse the DOE laboratories and fell far short of being comprehensive. However, a few technology areas were identified as having the potential to positively impact the mining and mineral industries. An attempt was made to match the most promising technologies with the Bureau researcher most likely to be able to employ the technology. This effort was limited by the short duration of this assignment.

A letter closing this initial effort was sent to the 20 DOE contact individuals. A copy of each letter is contained in the respective appendix.

U.S. DEPARTMENT OF ENERGY RESEARCH LABORATORIES

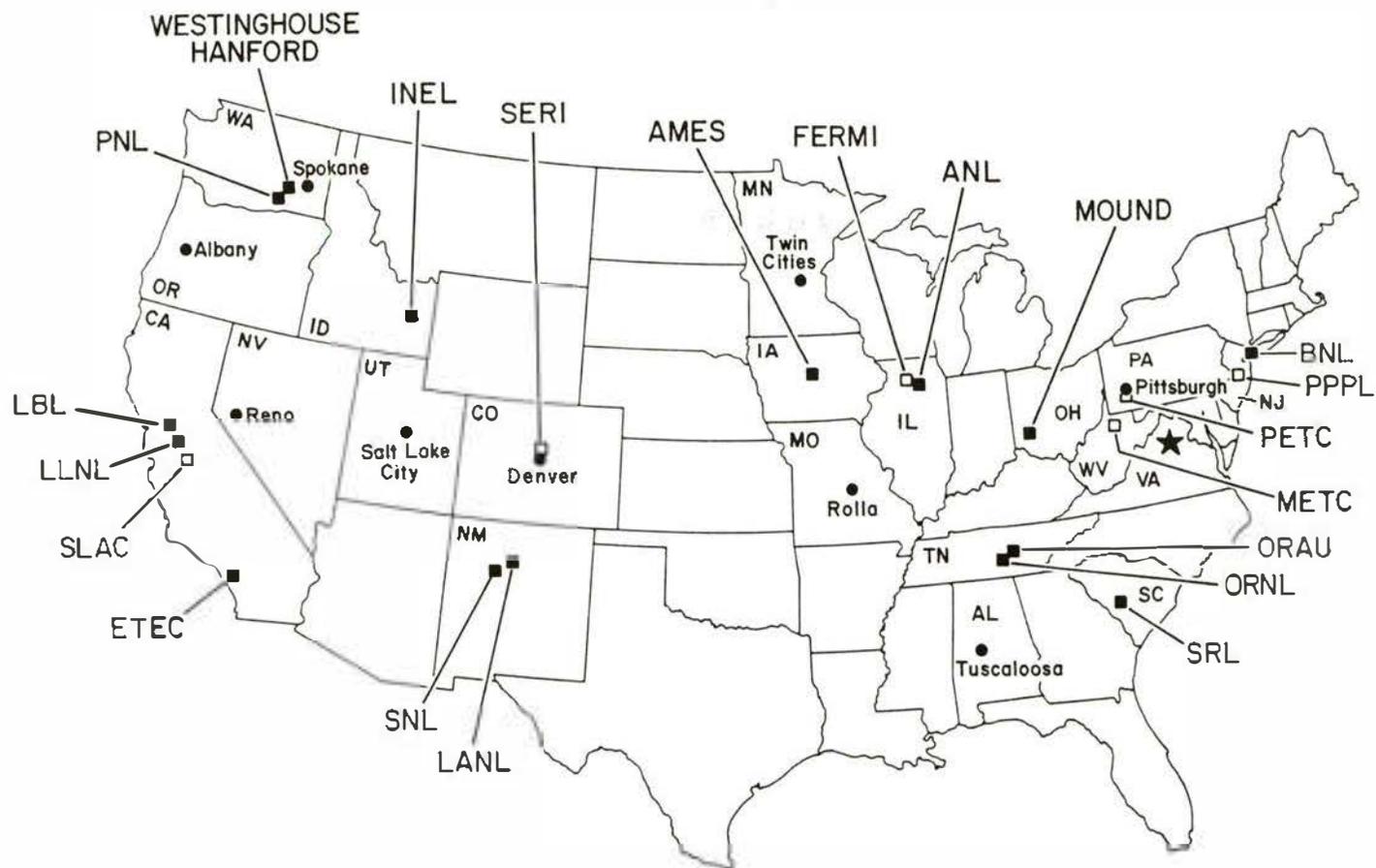
DOE research and development activities are conducted in nine large multiprogram laboratories, nine major single-program laboratories, and numerous other smaller laboratories. The research spans a broad range of scientific and technical areas, including energy research, defense programs, nuclear energy, conservation and renewable energy, and fossil energy programs.

The 21 laboratories originally contacted during this effort are major DOE laboratories with comprehensive technology transfer programs. The map on the following page shows the locations of these 21 facilities. The types of technology transfer efforts employed are: Information sharing, consulting, personnel sharing, user facilities, collaborative research (cost-shared), contract research (work for others), prototype development, entrepreneurial spinoffs, patent licensing, and consortia. The multiprogram laboratories employ the entire set of these technology transfer mechanisms. A number of major single-program laboratories also have designated user facilities.

All of the DOE laboratory directors eventually appointed a contact individual, except the Solar Energy Research Institute. Most of the directors responded with letters to Dr. Forshey; the remainder appointed a representative upon followup telephone contact. The majority of the comments from the directors were very supportive. Appendixes D through X correspond to each of the 21 DOE laboratories. Where applicable, each contains a copy of the written response of the laboratory directors.

The multiprogram laboratories are the core of DOE's research and development activities. Five of them emphasize energy and general science, while four focus on defense technology. Each DOE laboratory has a designated research mission, but they all have common scientific and technical capabilities. The five multiprogram laboratories that emphasize energy and basic science are: Argonne National Laboratory (app. D), Brookhaven National Laboratory (app. E), Idaho National Engineering Laboratory (app. F), Oak Ridge National Laboratory (app. J), and Battelle Pacific Northwest Laboratories (app. K). The four multiprogram laboratories that emphasize defense technology are: Lawrence Berkeley Laboratory (app. G), Lawrence Livermore National Laboratory (app. H), Los Alamos National Laboratory (app. I), and Sandia National Laboratory (app. L).

All of the multiprogram laboratories have very broad mission statements and annual operating budgets from \$100 million to \$1 billion. Due to this broad scientific base, technology matches with the Bureau research program were found at all six of the multiprogram laboratories visited. An enthusiastic response to using the "focal point" concept to exploit these opportunities for the benefit of the mining and mineral industries was found at all of the multiprogram laboratories. A general description of the multiprogram laboratories, their attitude toward the "focal point" concept, and the opportunities identified are presented in the separate appendixes for each laboratory.



5

LEGEND

- BOM research center
- ★ BOM headquarters
- DOE laboratories meriting future consideration
- DOE laboratories of limited interest

The major single-program laboratories have much narrower mission statements and vary dramatically in funding, from approximately \$26 million to \$700 million annually. The major single-program laboratories with demonstrated applicability to the "focal point" effort are: Ames Laboratory (app. M), EG&G Mound Applied Technologies (app. Q), Oak Ridge Associated Universities (app. R), Savannah River Company (app. U), and Westinghouse Hanford Company (app. X). The Energy Technology Engineering Center (app. N) was not visited, but could, based on limited information, demonstrate similar potential. As with the multiprogram laboratories, a general description of these major single-program laboratories, their attitude toward this effort, and the opportunities identified are presented in the separate appendixes for each laboratory.

OPPORTUNITIES

The opportunities for interaction with the DOE laboratories can be separated into five categories: Bureau-sponsored contract research by DOE, DOE-sponsored contract research by the Bureau, cooperative research efforts, end use of DOE technology by the Bureau, and end use of Bureau-developed technology by DOE. An industry partner may be added to any of these interaction types. Idaho National Engineering Laboratory (INEL) work for others funding is \$207 million in fiscal year 1990. This includes \$4 million from the Bureau. The Bureau-sponsored research is divided into two areas: Production Technologies and Conservation/Substitution Technologies. Production Technologies tasks are directed at developing advanced extraction technologies. Conservation/Substitution Technology tasks are directed toward establishing the technical base that will lead to the development of advanced materials and thus reduce U.S. dependence on foreign supplies of vulnerable and strategic materials.

George L. Vivian is the Bureau of Mines Technical Project Officer for Bureau Contract JO134035 with INEL. Despite the fact that his office is located within INEL and that many Bureau personnel have toured INEL on many separate occasions, INEL's biotechnology effort in methane destruction was not identified to Bureau management. Of particular interest was membrane wall oxidation of methane in mine ventilation air. The selected organisms convert methane to carbon dioxide and water. However, Jon C. Volkwein, Pittsburgh Research Center researcher working on biological destruction of methane, stated that he was first made aware of INEL's capabilities at a recent professional society meeting. Mr. Volkwein, as demonstrated by his letter to INEL biotechnology personnel (app. F), was excited to learn of the prospect of interaction supported by the management of INEL and the Bureau.

INEL is the only DOE facility with a permanent Bureau presence. Despite all the Bureau attention brought on by this \$4 million-per-year presence, a significant area of cooperation was overlooked. This illustrates that the "focal point" concept employed for the full range of Bureau research can identify opportunities in even the most familiar DOE laboratory. Further, researchers on both sides of the fence need encouragement and support from management to bring possible areas of cooperation to management's attention.

Advertisement of the Bureau's capabilities to other Federal laboratories can help bring contract research funding into the Bureau. Technical personnel at EG&G Mound Applied Technologies were aware of Bureau explosives safety research

performed under contract for the U.S. Department of Defense. However, the need for such testing by the Mound laboratory was only exposed to Bureau management by a "focal point" visit. At present, negotiations for DOE-sponsored contract explosives research by the Pittsburgh Research Center are ongoing.

The Mound facility interaction illustrates that advertisement of Bureau capabilities can bring research into the organization. While in this case Mound personnel were aware of Bureau expertise in explosives, the vast majority of DOE personnel contacted were quite surprised to learn of the wide variety of technologies being developed by the Bureau. Those DOE individuals who had dealt with the Bureau in the recent past remember the Bureau as an organization looking to fund mining research. Dispelling misconceptions about the Bureau can only help it acquire increased stature in the Federal laboratory community.

Cooperative research conducted jointly by DOE and the Bureau could enhance the mission performance of both organizations. Personnel at Westinghouse Hanford Company (WHC), Geotechnical and Environmental Engineering, are developing procedures for grouting of liquid nuclear waste with zeolite mixtures. Methodology to grout isolate existing buried, wooden, nuclear slurry waste containment structures was discussed. Boreholes are drilled around the cribs and grout is pumped in to fill voids, thus limiting ground water exposure. Much of the technology employed is mining-related. The drills and expanding grout mixtures would be very familiar to many Bureau researchers. The Hanford representatives would greatly desire to exchange geotechnology professionals with the Bureau to facilitate hands-on technology transfer. They also would like to consider the addition of Bureau experts to the WHC technical peer review procedure. Bureau involvement in this issue could bring mining equipment manufacturers into the environmental drilling field, thus forming an industry, Bureau, and DOE partnership that could increase the competitiveness of U.S. companies in the drilling technology area.

An example of cooperative research conducted jointly by DOE and the Bureau, supported by an industry partner, was initiated by the Twin Cities Research Center and the Sandia National Laboratory on computer simulation of rock fragmentation of crater blasts for oil shale retort bed preparation. The rock motion code, called Distinct Motion Code, and the fragmentation code PRONTO have application to bench and underground blasting. The PRONTO code is still under development, and the Bureau has conducted several bench blasts to provide data to evaluate the code. Industry interest is high, and Atlas Powder Company has contracted with Sandia to partially fund this research. This development indicates the type of three-way partnerships between the mining and minerals industries, the Bureau, and other Federal laboratories that a "focal point" effort could foster.

The possibility for end use of DOE technology by the Bureau is demonstrated by an interaction with Los Alamos National Laboratory (LANL). LANL's Earth and Environmental Sciences Division (EESD) developed with the underground testing of nuclear weapons in Nevada. The tests are conducted 2,000 feet underground and require knowledge of the local geology, hydrology, and fault systems. The EESD capitalizes on other technology developed at LANL. The strengths of the division are reservoir characterization and hazardous waste cleanup design. EESD geophysical capabilities include fiber-optic strain meters developed to

monitor the results of underground nuclear testing. EESD personnel have been considering methods to get these units to the mining community. They displayed considerable excitement at the prospect of meshing the talents and strengths of the two organizations on use of fiber-optic strain meters for underground stress evaluation, ground control design, and stress wave measurement in explosive testing. Immediate contact was made with EESD personnel by Pittsburgh Research Center ground control researchers, who have a project to develop fiber-optic strain meters starting on October 31, 1990. This demonstrates the power of the "focal point" concept to improve the Bureau's current mission performance.

End use of Bureau-developed technology by DOE is exemplified by the modified sulfur cement developed by the Albany Research Center, which is being used to encapsulate both radioactive and toxic waste by the Brookhaven National Laboratory and to solidify low-level radioactive waste by the Idaho National Engineering Laboratory. These developments indicate that the Bureau has technology with the potential to enhance DOE research. This type of interaction can only enhance the stature of the Bureau in the Federal laboratory system.

CURRENT BUREAU INTERACTION

To ascertain the present level of interaction between the Bureau of Mines and DOE laboratories, a memorandum introducing this effort and requesting a list of such interactions was sent from Dr. David R. Forshey, Associate Director--Research, to each of the nine Bureau Research Directors. All nine Directors provided a response. The responses varied in the level of detail provided. Some responses provided only a list of DOE researchers contacted; others described the results of selected interactions. Copies of the responses from all nine research centers are contained in appendix B. Despite the variation in detail, a few general trends may be identified from the more than 90 interactions reported. A wide disparity in level of involvement exists from center to center. All of the large multiprogram DOE laboratories and many of the single-program laboratories had been contacted by Bureau researchers in the recent past. The majority of interactions resulted from professional society involvement or scientific consultation on specific issues. Several Bureau researchers were involved in DOE program review committees. In some instances, DOE equipment was loaned to the Bureau. Bureau-funded contracts to DOE were listed.

The Bureau presently participates in a Governmentwide, Federal laboratory data base operated by the Federal Laboratory Consortium for Technology Transfer (FLC). The need for more effective use of federally developed technology led to the establishment of the FLC, a service organization that provides a link between individual laboratory members and potential users of Government-developed technologies. A general description of the FLC, significant technology transfer legislation, and the Spring 1990 meeting is contained in appendix C.

In conformance with the Federal Technology Transfer Act of 1986, the FLC Clearinghouse is a brokerage service that assists in the matching of user technical requests with appropriate Federal research capabilities. The clearinghouse is designed to link the potential user from industry, small business, local governments, or universities with a Federal laboratory person with special expertise in the user's area of interest. Once the linkage is

made, the arrangements for the actual technical exchange are between the user and the laboratory.

Over 500 Federal Government research and development laboratories and centers are represented by 160 individuals. Donald E. Ralston is the representative for all nine Bureau of Mines Research Centers. Fourteen Federal agencies are represented, including the Departments of Agriculture, Commerce, Defense, Education, Energy, Health and Human Services, Interior, Justice, and Transportation. Other members include: the Environmental Protection Agency, National Aeronautics and Space Administration (NASA), National Science Foundation, Tennessee Valley Authority, and Veterans Administration.

CONCLUSIONS AND RECOMMENDATIONS

A program to improve the Bureau of Mines' performance as the "focal point" for Federal laboratory technology applicable to the U.S. mining and minerals industry should be established. Such a program would enhance the performance of the Bureau and the cooperative Federal laboratories. A team of Bureau professionals knowledgeable in mining systems, metallurgy, and environmental engineering should be the core of this effort. To reinforce the Bureauwide nature of the "focal point" program, it should be part of the Bureau's Technology Transfer Office and report to the Washington Office. However, the program should be physically located at a large research center and provided with administrative and clerical support. The geographic location of the research center, ease of air travel to and from the research center, and the attitude of the research center's management to the "focal point" effort should be factors in selecting the host center. Locating this effort in the field serves to foster current knowledge of Bureau research efforts by "focal point" personnel.

The technology needs of the individual Bureau research centers can only be met and the capabilities capitalized upon if they are adequately identified. The examples of opportunities identified previously are dominated by interactions with the Bureau's Pittsburgh Research Center because the initial effort was conducted by personnel intimate with the Pittsburgh Research Center. However, technology matches were identified that could be used by all nine research centers. Therefore, it is recommended that the "focal point" professionals develop and maintain a comprehensive knowledge of the entire Bureau research program.

Advertisement of Bureau capabilities throughout the Federal laboratory system is a critical first step in acquiring the information necessary for technology matching. Improved Bureau participation in the Federal Laboratory Consortium for Technology Transfer (FLC) is one mechanism to accomplish this. The Bureau's nine research centers should be individually listed as to their specific capabilities in the Federal laboratories data base component of the FLC Clearinghouse. "Focal point" professionals should attend the semiannual FLC meetings to develop professional relationships with other Federal laboratory technology transfer representatives. Articles discussing the "focal point" concept and the interagency Bureau "focal point" technology transfer success stories should be placed in the FLC Newsletter and publications such as McGraw-Hill's Inside Energy and Technology Transfer Report. Jonathan Root, Program Manager, National Technology Transfer Center (NTTC), NASA, should be provided

with Bureau input in the planning of the \$26 million NTTC, to be housed at the Wheeling Jesuit College, Wheeling, WV.

The "focal point" effort should be a concentrated effort to identify opportunities of benefit to the U.S. mining and minerals industry, the cooperating Federal laboratory, and the Bureau of Mines. It is up to individual researchers, supported by their research center management, to capitalize on the opportunity. The "focal point" technical staff should guard against being drawn too deeply into any one particular research area. As demonstrated by the examples cited above and in the appendixes, the Bureau is already involved in every type of interaction this effort hopes to foster. This concept should endeavor to improve Bureau mission performance by providing line management with the information, not by setting research priorities.

Dr. David R. Forshey, Associate Director--Research, Bureau of Mines, in his speech at the April 1990 Research Management Meeting in Pittsburgh, PA, spoke of one Bureau of Mines managed with leadership and vision. Leaders, no matter how well trained or motivated, need current and valid information to turn their visions into reality. An ongoing "focal point" effort has the potential to provide Bureau management with the critical information necessary to enhance Bureau mission performance. Further, this effort could establish the Bureau as a leader within the Federal laboratory system in interagency technology transfer.

Appendix A

**Summary of Bureau of Mines Research Program
and Initial Communications of Focal Point Effort**

APPENDIX A

BUREAU OF MINES RESEARCH

The objective of the Bureau's research program is to enhance worker health and safety, improve the environmental compatibility of mining and mineral processing operations, improve mineral resource accessibility and conservation, and stimulate innovations in the U.S. mining industry. To achieve this objective, the research program is structured into three program areas: (1) Health, Safety, and Mining Technology, (2) Minerals and Materials Science and (3) Environmental Technology.

Health, Safety, and Mining Technology

The Health, Safety, and Mining Technology program consists of two principal research components and addresses the metal, non-metal, and coal producing industries.

The first component, Health and Safety Technology, is directed toward improving mining practices and devising methods that can be adopted to reduce work-related fatalities, nonfatal injuries, and diseases of miners. The research effort is based largely on trends in accident and health statistics, and needs established in consultation with the Mine Safety and Health Administration (MSHA), the National Institute for Occupational Safety and Health (NIOSH), and the industry. The research has six areas: (1) Occupational Health, (2) Ground Control, (3) Human Factors, (4) Mine Safety Systems, (5) Mine Disaster Prevention, and (6) Experimental Facilities.

The second component, Mining Technology, addresses the area of Advanced Mining Systems. This area seeks to provide the necessary mining technology that will ensure adequate supplies of minerals and energy from domestic sources for our economy.

Minerals and Materials Science

The Minerals and Materials Science program is directed toward providing the science base needed by the mineral sector of the U.S. economy by developing competitive processing technologies. In addition, the program provides basic knowledge to stimulate new uses for domestically produced minerals and to stimulate development of domestic substitutes for materials that require significant quantities of imported strategic and critical materials. The research consists of three areas: (1) Vulnerable, Strategic, and Critical Metals, (2) Minerals and Metals Essential to the Nation, and (3) Materials.

Environmental Technology

The Environmental Technology program develops technologies to enable cost-effective compliance with environmental standards; develops technologies to clean up contamination of land and water resulting from past and present mining and mineral processing systems that reduce the quantities of wastes generated and minimize environmental impacts; and ensures that current and future environmental regulations are based on sound scientific data. Also mitigation of surface subsidence caused by underground mining and the

reclamation of surface mines and waste disposal areas are addressed. Environmental Technology encompasses two areas: (1) Control of Mine Drainage and Liquid Wastes, and (2) Solid Waste Management and Subsidence.

Emphasis and Location of Research

Bureau research is conducted at nine research centers across the country. The portions of the research program conducted at each center is outlined below.

ALBANY RESEARCH CENTER
1450 Queen Avenue, S.W.
Albany, Oregon 97321
George J. Dooley III, Research Director

Health, Safety, and Mining Technology

Mine Safety Systems

- Laboratory analysis of wire rope.

Minerals and Materials Science

Vulnerable, Strategic, and Critical Metals

- Carbothermic prereduction of domestic manganese ore.
- Superconducting, ultrahigh magnetic field separation of minerals.
- Oxidation and sulfatization for selective extraction of critical metals from low grade ores.
- Mineralogical characterization through optical microscopy, scanning electron microscopy, and image analysis.
- Chromium, manganese, and platinum group metals recycling survey.
- Scrap identification, sorting and characterization.
- Titanium recovery with halide leach technology.

Minerals and Metals Essential to the Nation

- Magneto-hydrodynamics evaluation of arc stability in arc furnace steelmaking.
- Emulsion membrane extraction of metals from dilute solutions.
- Smelting of sulfide concentrate using calcium ferrite slag.
- Selective organic extractants for membrane technology.

Materials

- Advanced inter-metallic composites for severe service environments.
- Vapor phase reactions for non-oxide powders.
- Sulfur based composite cements for hostile environments.
- Metal castings strengthened by fibers and particulates.
- Aqueous corrosion resistant coatings for high-strength metallic and non-metallic materials.
- Corrosion resistant materials for minerals processing.
- High temperature interstitial solubility in metal-carbon systems.
- Alloying technology utilizing inert and reactive gases.

Environmental Technology

Solid Waste Management and Subsidence

- On-site recycling of spent aluminum potlining to continuous anodes.
- Treatment and control of mineral and metal contaminated wastes.

DENVER RESEARCH CENTER
P. O. Box 25086
Building 20, Denver Federal Center
Denver, Colorado 80225
Edward E. Hollop, Research Director

Health, Safety, and Mining Technology

Occupational Health

- Development of radiation detection equipment.

Ground Control

- Automated geotechnical mine monitoring combined with ground control expert systems for design of mine openings.
- Numerical modeling of in-mine structures.
- Microseismic monitoring for rock burst and coal bump prediction.
- Coal mine longwall gate entry system and destressing design with geotechnical measurements and numerical modeling.
- Radar and reflection tomography for coal outburst prediction.
- Computer assisted analysis of satellite images for hazard detection.
- Computer data base on ground control conditions in US coal mines.
- Convergence rate related with salt dome entry instability.
- Ultrasonic evaluation of roof bolt performance.

Mine Safety Systems

- Coal pipeline development utilizing thixotropic, "Bingham State," coal slurry or magnetic levitation of coal containers with ceramic magnets.
- Air lift hydro-hoist for coal or ore transport.
- Underground in situ leach manganese mining of stopes with safe lixivants.

Environmental Technology

Solid Waste Management and Subsidence

- Cross well acoustic tomography to locate underground mine openings and subsidence.
- Prediction of subsidence over room-and-pillar and longwall coal mines.
- Evaluation of western Superfund sites for the EPA.
- Seismic monitoring to detect, locate, and track underground subsidence.

PITTSBURGH RESEARCH CENTER
Cochrans Mill Road
P. O. Box 18070
Pittsburgh, Pennsylvania 15236
John N. Murphy, Research Director

Health, Safety, and Mining Technology

Occupational Health

- Dust measurement and control.
- Noise measurement and control.
- Gas contaminate measurement.
- Coal mine dust control expert systems.

Ground Control

- Identification of major geological structures and methodologies for dealing with related ground control problems.
- Influence of stream valleys on ground control conditions.
- Coal mine ground control aspects of longwall mining.
- Numerical modeling of mining methods for bump prone conditions, based on detailed in-mine geotechnical evaluations.
- Design of arch canopies for rehabilitation of high roof falls.

Human Factors

- Computer based mine emergency practice teaching systems.
- Bio-mechanical analysis of human lifting.
- Human and management implications of robotics development.

Mine Safety Systems

- Electrical motor failure prediction system.
- Effect of electrode material and environmental conditions on intrinsic safety.
- Ground fault safety systems.
- Wire rope hoisting systems.
- Fiber optic gas detection.

Mine Disaster Prevention

- Safety and efficiency of mine explosives.
- Mine fire escape simulation and training.
- Breathing apparatus systems.
- Methane liberation prediction and control.

Experimental Facilities

- Full-scale underground limestone mine and surface test facility.
- Full-scale underground coal mine test facility.
- Full-scale mine roof simulator for longwall shield testing.

Advanced Mining Systems

- Longwall roof support development.
- Longwall recovery system improvement.
- Coal mine equipment maintenance expert systems.
- Remote control continuous miner systems.
- Passive thermal video for coal rock interface detection.
- Lasernet guidance systems for automated mining equipment.
- Highwall mining systems.
- Computer assisted continuous haulage systems.
- Zinc leach recovery from sphalerite bearing carbonate spoil piles with acid mine drainage containing acidophilic iron-oxidizing bacteria.
- Strategic and critical minerals deposit review.

Environmental Technology

Control of Mine Drainage and Liquid Wastes

- In-line lime treatment of acidic metal drainage at the Bunker Hill site.
- Metal accumulation in food chain.
- Polyurethane stream sealing.
- Pozzolanic cement sealing of refuse piles to prevent acid mine drainage.
- Leaching pyrite from solid coal waste.

Solid Waste Management and Subsidence

- Subsidence prediction over active coal mines and abandoned mine lands.
- Abandoned mine lands fire prevention.
- Cryogenic gas for abandoned mine lands fire fighting.
- Pneumatic stowing for subsidence prevention.
- Zinc smelter cinder pile runoff treatment with anaerobic bacteria.

RENO RESEARCH CENTER
1605 Evans Avenue
Reno, Nevada 89512

Richard E. Siemens, Research Director

Health, Safety, and Mining Technology

Advanced Mining Systems

- Non-cyanide leachants for in situ gold extraction.

Minerals and Materials Science

Vulnerable, Strategic, and Critical Metals

- Carbamate and fluosilicic leach recovery of manganese from steelmaking slag.
- Cyanide recovery of platinum-group metals from spent automobile catalytic converters.
- *T. ferroxidans* bacterial preleaching of platinum-group metal from sulfide ores and flotation concentrates.

Minerals and Metals Essential to the Nation

- Catalysts and catalyzed leach systems improve hydro-metallurgy processes.
- Rapid rate reduction of metal oxides and sulfides with rocket combustion smelting technology.
- Physical beneficiation and acid leaching of graphite from kish steelmaking waste.
- Molten-salt and aqueous electrolysis processes to produce neodymium and calcium metals.
- In place copper leaching chemistry.
- Basic copper and manganese heap leaching chemistry.
- Microwave heating enhances ore minerals processing.

Environmental Technology

Control of Mine Drainage and Liquid Wastes

- Removal of metal and other cations from water using natural zeolites (hydrated silicates).

Solid Waste Management and Subsidence

- Effective closure methods for metallurgical processing operations.
- Fixing or removing lead and other metals from automobile shredder fluff.

ROLLA RESEARCH CENTER

P. O. Box 280

1300 Bishop Avenue

Rolla, Missouri 65401

D. L. Paulson, Research Director

Minerals and Materials Science

Vulnerable, Strategic, and Critical Metals

- Minerals processing by leach sulfidation partition technology.
- Conservation of mineral values in stainless steel and titanium metal annealing and pickling processes (electron microscope).
- Electrolytic recovery of chromium, cobalt, and nickel from mixed and contaminated superalloy scrap.

Minerals and Metals Essential to the Nation

- Gravity/flotation separation of rare earth metals from Missouri iron mines.
- Improved base metal electro-winning leach systems development.

Materials

- Electro-galvanizing using zinc wastes.
- Metal joining methods for high-technology electronic applications.

Environmental Technology

Control of Mine Drainage and Liquid Wastes

- Electrolytic decontamination of impoundments.

Solid Waste Management and Subsidence

- Removal of halogens (fluorine) from zinc oxides by pyro-hydrolysis.
- Electro-winning of lead from battery scrap.
- Carbonation and acid leaching of lead contaminated soils.
- Treatment of electroplating and metal finishing residues.
- Thermal processing and sulfuric acid leaching of mercury waste.
- Flotation removal of metal contaminants of Missouri lead mill tailings.

SALT LAKE CITY RESEARCH CENTER
729 Arapeen Drive
Salt Lake City, Utah 84108
Stephen D. Hill, Research Director

Health, Safety, and Mining Technology

Advanced Mining Systems

- Processing systems for in situ mining leach solutions.

Minerals and Materials Science

Vulnerable, Strategic, and Critical Metals

- Strategic and critical metal ores from Alaska.
- Chloride solution processing of superalloy scrap.
- Beneficiation and processing of ocean floor minerals.
- Scandium recovery from domestic resources.
- Metals recovery from advanced material scrap.

Minerals and Metals Essential to the Nation

- Redox control of flotation.
- Precious metals recovery from refractory ores.
- Super-critical fluid technology.
- Tantalum, niobium, and refractory metals recovery.
- Advanced application of flotation.
- Gallium and germanium from domestic sources.

Environmental Technology

Control of Mine Drainage and Liquid Wastes

- Immobilized extractant technology for waste water treatment.
- Biological and hydro-chemical decontamination of mining and milling waters.
- Hazardous wastes on federal lands.

Solid Waste Management and Subsidence

- Treatment of copper industry wastes.

SPOKANE RESEARCH CENTER
E. 315 Montgomery Avenue
Spokane, Washington 99207
Douglas D. Bolstad, Research Director

Health, Safety and Mining Technology

Ground Control

- Undercut-and-fill mining system design for pitched coal seams with numerical modeling and backfill physical properties testing.
- Forepole coal mine roof pre-support design with numerical modeling, in-mine geotechnical monitoring, and air injection testing.
- Macroseismic, geologic, backfill, and numerical modeling design of mine design to prevent rock bursts.
- Automated geotechnical mine monitoring combined with ground control expert systems for coal mine roof support.
- Laboratory and in-mine testing of bolting and concreting for coal pillar rib stability enhancement.
- Fully grouted roof bolt performance during longwall coal mining.
- Roof rock physical properties evaluation during roof bolt installation by smart roof bolter.
- Numerical modeling of mining methods for bump prone conditions, based on in-mine geotechnical and geomechanical laboratory evaluations.
- Remote and automated mining roof support systems for PRC computer assisted continuous miner.

Mine Safety Systems

- Roof bolt drilling with intelligent computer control under the guidance of an expert system.
- Electromagnetic detection of wire rope defects and effects of mine water corrosion on mine hoist rope life.

Advanced Mining Systems

- Stereo digitizing for measuring rock fracture strength, Livermore Laboratories provided mechanical profilometer information as comparison.
- Low viscosity resins to strengthen fractured rock.
- Geotechnical monitoring to evaluate cable bolt support characteristics.
- Numerical modeling and geotechnical monitoring to evaluate under hand cut and fill ore mining method.
- Environmental and structural effects of various mine backfills.
- In situ leach metal mining design.
- Numerical modeling, physical properties testing, and detailed in-mine geotechnical evaluations for hard rock shaft and raise design.

Environmental Technology

Control of Mine Drainage and Liquid Wastes

- Hydrogeologic determination of heavy metal leaching from abandoned mine lands.
- Multivariate statistics on geochemical analysis of metal tailings water, show site specifics are critical.

Solid Waste Management and Subsidence

- Acetate leaching of soils contaminated with heavy-metal fallout from lead smelters drives metals deeper into soil.
- Reclamation of sub-arctic and arctic mining areas.

TUSCALOOSA RESEARCH CENTER
University of Alabama Campus
P. O. Box L
Tuscaloosa, Alabama 35486
David R. Flinn, Research Director

Minerals and Materials Science

Minerals and Metals Essential to the Nation

- Ultrasonic, in-line static mixer improvements in copper and phosphate ore flotation kinetics.
- Simultaneous grinding/leaching of copper from chalcopyrite with ferric ion improved the kinetics of the controlled leach reactions.
- Dielectric heating properties of minerals.
- Microwave induced plasma tungsten carbide process.
- Acid/alcohol leaching of phosphate ores over acid/water leaching.
- Chemical and physical mechanisms of dewatering of mineral ores.
- Expert systems to improve recovery of mineral values during the flotation sequence.

Materials

- Advanced ceramic composites for severe service conditions.
- Improved properties of advanced ceramics.
- Controlled microstructure of advanced ceramic materials (TiAlON spinel composites).

Environmental Technology

Control of Mine Drainage and Liquid Wastes

- Carolina cyanide leach gold wastes environmental assessment.
- Mineral processing waste water treatment.

Solid Waste Management and Subsidence

- Elimination of soil contamination at mining/mineral processing sites.
- Treatment of phosphate wastes.

TWIN CITIES RESEARCH CENTER
5629 Minnehaha Avenue South
Minneapolis, Minnesota 55417
Lewis V. Wade, Research Director

Health, Safety, and Mining Technology

Occupational Health

- Low sulfur low aromatic diesel fuel development for underground mines.
- Measurement of diesel aerosol and carcinogenic hazard evaluation.
- Chemical and biological diesel exhaust control.
- Computer aided cutting drum design for coal and silica dust control.

Ground Control

- Seismic geophysical sensing of fracture systems.
- Blasting design for safer surface mine pitwalls and underground hanging walls.

Human Factors

- Effect of biological factors on accidents.

Mine Safety Systems

- Measurement and effects of vibration on surface mine equipment.
- Reliability engineering of conveyor belt haulage systems.

Mine Disaster Prevention

- Procedures for safer blasting.
- Sulfide oxidation for coalbed self heat potential reduction.
- Fire detection, warning, and suppression systems.

Advanced Mining Systems

- Hydraulic fracturing to induce mine caving.
- Microwave, chemical, and abrasive jet assisted mechanical drilling.
- Leach solution, blasting, and fluid flow design for in situ mining of copper and manganese.
- Microwave fracturing for in situ mining.
- Seabed and lunar mining systems.

Minerals and Materials Science

Vulnerable, Strategic, and Critical Minerals

- Upgrading of manganese ore by oxidizing heat treatment.

Minerals and Metals Essential to the Nation

- Enhanced oxidation of magnetite pellets with oxygen enriched air and digital image analysis of ore.

Environmental Technology

Control of Mine Drainage and Liquid Wastes

- Chemically assisted drilling for void detection.

Solid Waste Management and Subsidence

- Subsidence prediction and structural damage prevention over active coal mines.
- Improved re-vegetation over coarse mine tailings.
- Biological treatment of contaminated non-coal mine drainage.

U.S. BUREAU OF MINES LIBRARY
5629 Minnehaha Avenue South
Minneapolis, MN 55417



United States Department of the Interior

BUREAU OF MINES
2401 E STREET, NW.
WASHINGTON, D.C. 20241

December 19, 1989

Dr. William Wiley
Director
Battelle Pacific Northwest Laboratory
P.O. Box 999
Richland, WA 99352

Dear Dr. Wiley:

On March 20, 1989, a meeting was held at the U.S. Bureau of Mines' Pittsburgh Research Center at the request of Senator Domenici of New Mexico. The purpose of the meeting was to engender a technical relationship between the National Laboratories and the minerals industry. The ultimate goal being to enhance our Nation's minerals industries through technology transfer. Representatives of Government, academia, and the minerals industry attended. During the meeting, the Director of the Bureau of Mines, Mr. T S Ary, suggested that since the Bureau is the focal point for mining research in the U.S., it would be appropriate for it to act as the liaison between the National Laboratories and the minerals industry. This idea was well received by the participants and put into place by a letter to all attendees from the Secretary of Interior, Manuel Lujan, Jr. In it he stated, "The Bureau of Mines has served effectively as the Federal focal point on technology issues with the mining industry, and I expect them to continue to serve in this capacity. Since the Bureau has established effective communication mechanisms between the Federal sector and the industry, I would be pleased to have them serve as the interface with the National Laboratories regarding mining issues."

As the first step in this process, Alan A. Campoli, Mining Engineer, Bureau of Mines, Pittsburgh Research Center, P.O. Box 18070, Pittsburgh, PA, 15236 has been selected to perform a six month investigation to better define the proper role of the Bureau in this area. The assignment will be accomplished with the completion of the following tasks:

1. Develop an overall picture of the National Laboratories research output related to minerals industry. Determine the form, volume, and accessibility of available National Laboratory technical information. Acquire reports that summarize National Laboratory research efforts.
2. Visit a number of National Laboratory facilities to obtain firsthand information on current minerals related research and technology transfer efforts. Explore the possibility of a National Laboratory contribution to a Bureau liaison effort.

3. Assess the relevancy of National Laboratory technology to the minerals industry and Bureau research. Determine what Bureau effort would be required to put the technology into a form directly usable to the U.S. minerals industry. Isolate the impact of the technology on existing Bureau research.
4. Prepare a summary report which details findings and recommends the role of the Bureau as a possible liaison between the National Laboratories and the U.S. minerals industry. A detailed implementation plan will be part of the summary report.

It is hoped that Bureau activity on this issue will augment the effectiveness of technology transfer programs currently in place. This effort can not be successful without the cooperation and assistance of National Laboratory managers, such as yourself. If you concur, please designate a contact point within your organization to facilitate effective communication on this issue, and inform me of this selection. A copy of "U.S. Bureau of Mines Research 88 - a summary of significant results in mineral technology and economics" is enclosed. This publication discusses the structure, mission, activities, and accomplishments of the Bureau of Mines. Any general comments or suggestions on this effort are encouraged.

Sincerely,

David R. Forshey

David R. Forshey
Associate Director--Research, W0



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



February 2, 1990

Mr. L. Donald Williams
Director of Technology Transfer
Battelle Pacific Northwest Laboratories
Battelle Boulevard
P.O. Box 999
Richland, WA 99352

Dear Mr. Williams:

On March 20, 1989, a meeting was held at the U.S. Bureau of Mines' Pittsburgh Research Center at the request of Senator Domenici of New Mexico. The purpose of the meeting was to engender a technical relationship between the National Laboratories and the minerals industry. The ultimate goal being to enhance our Nation's minerals industries through technology transfer. Representatives of Government, academia, and the minerals industry attended. During the meeting, the Director of the Bureau of Mines, Mr. T. S. Ary, suggested that since the Bureau is the focal point for mining research in the U.S., it would be appropriate for it to act as the liaison between the National Laboratories and the minerals industry. This idea was well received by the participants and put into place by a letter to all attendees from the Secretary of the Interior, Manuel Lujan Jr. In it he stated, "The Bureau of Mines has served effectively as the Federal focal point on technology issues with the mining industry, and I expect them to continue to serve in this capacity. Since the Bureau has established effective communication mechanisms between the Federal sector and the industry, I would be pleased to have them serve as the interface with the National Laboratories regarding mining issues".

The objective of the Bureau is to enhance worker health and safety, improve the environmental compatibility of mining and mineral processing operations, improve mineral resource accessibility and conservation, and stimulate innovations in the U.S. mining industry. It is hoped that cooperation between the National Laboratories and the Bureau will aid in these endeavors. A starting point in this process is an assessment of the relevancy of National Laboratory technology to mining. Please find enclosed a summary of the current Bureau research program. While this summary cannot completely illustrate the wide range of technology applicable to the mineral industries, it does indicate the major areas of interest.

I would like to arrange a visit to your facility to obtain first hand information on current mining related research and technology transfer efforts. We can also discuss the level of participation by your organization in this activity.

In thinking about this project, I have come up with a list of possible technology transfer mechanisms. They are:

1. Institute regular mailings of generic technology transfer material from National Laboratories to designated Bureau representatives.
2. Designate National Laboratory technology transfer personnel to determine what activities or results are appropriate and report them to the Bureau's representative(s).
3. Select National Laboratory and Bureau technical experts on appropriate technology areas, to foster two-way information flow.
4. The National Laboratory and Bureau joint author special reports on particularly promising mineral industry related developments.
5. National Laboratory and Bureau co-sponsored mineral industry seminars on emerging technologies.

As the designated Battelle Pacific Northwest Laboratories point of contact, please review the enclosed document and consider the options outlined above. I will contact you in the near future to discuss this cooperative effort.


Alan A. Campoli
Mining Engineer

Attachment

cc: HKSacks
AACampoli
PRC Files

Appendix B

**Responses From Research Directors
Regarding Interactions With DOE**



United States Department of the Interior

BUREAU OF MINES

1450 QUEEN AVENUE SW
ALBANY, OREGON 97321-2198



March 21, 1990

Memorandum

To: Alan A. Campoli, Mining Engineer, Pittsburgh Research Center
From: Research Director, Albany Research Center
Subject: Department of Energy National Laboratories Liaison Activities

Please find the listing of previous National Laboratories and Bureau interaction is attached. If you have any questions, please call.


George J. Dooley, III

Attachment

Rick D. Wilson, Metallurgist, Albany Research Center

Contact

Dr. G.C. Macame

Oak Ridge National Laboratory,
Oak Ridge, TN 37830 (FTS 624-6917)

Discussed iron aluminide intermetallics.

Rick D. Wilson, Metallurgist, Albany Research Center

Contact

Dr. Steve Bremmer

Battelle Northwest Labs
Richland, Washington

Discussed intermetallics.

Rick D. Wilson, Metallurgist, Albany Research Center

Contact

Dr. Hal Krause

Idaho National Engineering Labs
Idaho Falls, ID

Computer modeling of heat transfer during welding.

Ralph Nafziger, Supervisory Metallurgist, Albany Research Center

Contact

Dr. Thomas Eddy and Mr. Alan
Donaldson

Idaho National Engineering Labs
Idaho Falls, ID

Ralph Nafziger, Supervisory Metallurgist, Albany Research Center

Contact

Sy Katz, GM

Cupola Modeling Study

Ralph Nafziger, Supervisory Metallurgist, Albany Research Center

Contact

Romans Reedy

Lawrence Berkeley Laboratory

Jack White, Metallurgist, Albany Research Center

Contact

Savannah River Facility

Vitrification

Ralph Nafziger, Supervisory Metallurgist, Albany Research Center

Contact

Argonne National Laboratory

DOE Iron and Steel Initiative

Dave Nilsen, Metallurgist, Albany Research Center

Contact

Brent Hiskey

University of Arizona

DOE research program to "increase the energy efficiency and enhance the competitiveness of American steel, aluminum, and copper industries by providing federal incentives for the establishment of public-private sector research and development partnerships."

Ralph Nafziger, Supervisory Metallurgist, Albany Research Center

Thomas Ochs, Metallurgist, Albany Research Center

Contact

Sandia National Laboratory
Secondary Melting

Attended a conference

Jane Knoper, Chemist, Albany Research Center

Contact

Buddy Ratner and
David Castner

ESCA and Surface Analysis Center for Biomedical
Problems, Seattle, Washington

Discuss ESCA technology, 1988-1989 (telephone and visit).

Jane Knoper, Chemist, Albany Research Center

Contact

Peter a Pryfogle

Idaho National Engineering Laboratory,
Idaho Falls, Idaho

Discuss biotechnology programs at INEL both BOM-sponsored and non BOM-sponsored to determine possibly how surface science technology might impact biotechnology research, January 1990 (telephone).

Jane Knoper, Chemist, Albany Research Center

Contact

Randy Wright

Idaho National Engineering Laboratory,
Berkeley, California

Discuss experience in working with Mn ores and Mn oxidation state determinations and performance of surface science instrument ESCA's, 1988-1989.

Jane Knoper, Chemist, Albany Research Center

Contact

Robert Fisher

Lawrence Berkeley National Laboratory

Discuss arrangements for the 12th International Congress for Electron Microscopy, 1989-1990.

Jane Knoper, Chemist, Albany Research Center

Contact

Lawrence Berkeley National Laboratory
National Center for Electron Microscopy
Berkeley, California

Contacted to get literature on this national resource for potential use by Renon Research Center, February 15, 1990.

Jane Knoper, Chemist, Albany Research Center

Contact

Marty Carr

Sandia National Laboratory
Albuquerque, New Mexico

Contacted and visited to discuss and use electron diffraction software for transmission electron microscopy, June-August, 1989.

Jane Knoper, Chemist, Albany Research Center

Contact

John Reddy

Argonne National Laboratory
Argonne, Illinois

Discussed methodology of specimen preparation for TEM, 1988-1989.

John Dunning, Supervisory Metallurgist, Albany Research Center

Contact

R. N. Wright and
V. W. Storhok

INEL
Idaho Falls, Idaho

Technical monitor. Project: Wear-Resistant Materials.

John Dunning, Supervisory Metallurgist, Albany Research Center

Contact

Mark Stone

INEL

Idaho Falls, Idaho

Technical monitor. Project: Inorganic Engineering Polymers.

John Dunning, Supervisory Metallurgist, Albany Research Center

Contact

R. M. Neilson

INEL

Idaho Falls, Idaho

F. H. Froes

University of Idaho

Committee to propose program on Synthesis of Nanocrystalline Material.



United States Department of the Interior

BUREAU OF MINES

P. O. BOX 25086
BUILDING 20, DENVER FEDERAL CENTER
DENVER, COLORADO 80225



Office of the Research
Director

February 12, 1990

Memorandum

To: Alan A. Campoli, Mining Engineer, Pittsburgh Research Center
From: Staff Engineer, Denver Research Center
Subject: National Laboratory Contacts

As requested December 19, 1989, below is the only contact we have had with the National Laboratories. If I can be of further help, please call (FTS-776-0747).

National Lab Contact by DRC:

Drs. Larry Rockwell and Robert Kranz visited Los Alamos National Laboratory in early December 1989 to discuss the possible application of chaotic dynamics to rock burst mechanics. This meeting was with the Theoretical Division, of which Kranz used to be a part. Also, a short-term loan of Los Alamos' acoustic emission test equipment was made to DRC to help in Denver's research into rock failure studies. The electronic equipment was returned to Los Alamos in January. It is hoped that Los Alamos rock mechanics researchers will soon visit DRC to discuss further, cooperative ground control work in mines.

Guy A. Johnson

DOE LABORATORY CONTACTS
WITH
PITTSBURGH RESEARCH CENTER

John J. Sammarco, Electrical Engineer, Electrical and Electronic Systems,
Pittsburgh Research Center

Contact:

Alfred C. Watts
Exploration Systems, Development Division II
Sandia National Laboratory

Interaction:

Contact made by John Sammarco in 1989, to explore the feasibility of using an inertial navigation system for performing the navigation function on a computer-assisted continuous mining machine. This cooperation is not being pursued at this time.

Kenneth L. Williams, Supervisory Physical Scientist, Electrical and
Electronics Systems, Pittsburgh Research Center

Contact:

Dr. Bill D. Nichols
Los Alamos National Laboratory

Interaction:

Contract JO-245010 performed by Los Alamos National Laboratory, "3-Dimensional Computer Modeling of Particle Behavior in Airflow Streams Around Aerosol Samplers." Contract report was never received.

Kenneth L. Williams, Supervisory Physical Scientist, Electrical and Electronic
Systems, Pittsburgh Research Center

Contact:

Dr. Solomon Zaromb
Environmental Research Division
Argonne National Laboratory

Interaction:

Contract HO-378050 performed by Argonne National Laboratory, "Solid-Electrolyte Methane Sensors." Contract terminated prematurely due to lack of funding.

David M. Hyman, Supervisory Physical Scientist, Environmental Technology,
Pittsburgh Research Center

Contact:

Coal Preparation Group
Pittsburgh Energy Technology Center

Interaction:

Cooperative research into pyrite oxidation mechanisms and coal depyritization under negotiation. BOM conceived experiments to be conducted with sophisticated DOE lab equipment.

John G. Kovac, Supervisory Physical Scientist, Mining Systems and Human Engineering, Pittsburgh Research Center

Contacts:

Alan Heck, Los Alamos National Laboratory
Bruce Held, Lawrence Livermore National Laboratory

Interaction:

Contact individuals for life-support systems information.

Dr. Robert S. Hedin, Research Biologist, Environmental Technology, Pittsburgh Research Center

Contact:

Argonne National Laboratory

Interaction:

Field investigation of old refuse piles will be statistically analyzed to determine the relationships between reclamation and waste chemistry and water quality.



United States Department of the Interior

BUREAU OF MINES

RENO RESEARCH CENTER

1605 EVANS AVENUE
RENO, NEVADA 89512-2295

February 20, 1990

Memorandum

To: Research Director, PRC
Attention: A. A. Campoli, Mining Engineer

From: Acting Research Director, RERC

Subject: DOE National Laboratories Liaison Activities

Liaison activities between the RERC and DOE National Laboratories have been ongoing to a limited extent for a number of years. This dialogue has been part of an effort to identify mining and mineral processing research ideas related to energy conservation and environmental concerns. Liaison activities within the last four years were with the Los Alamos National Laboratory, Los Alamos, New Mexico concerning the RERC projects "Microwave Heating of Ore Minerals"; "Removal of Metal and Other Cations From Water Using Zeolites," and "Molten-Salt Electrolysis." Our contacts at Los Alamos were Drs. Bruce Erdal and David Bush - zeolites; Mr. Larry Avens - electrolysis, and Mr. Joel Katz - microwave heating.

Regarding your document summarizing the current Bureau of Mines research program, a review was completed and comments, as note in the text, were incorporated to reflect the FY 90 research program.

If you have any questions on this subject, please feel free to call E. G. Valdez at FTS 470-5013.

E. G. Valdez, acting for
D. D. Bolstad

Attachment

cc: DRForshey, WO
HKSacks, PRC



United States Department of the Interior
BUREAU OF MINES

1300 N. BISHOP AVENUE
ROLLA, MISSOURI 65401

January 16, 1990

Memorandum

To: Alan.A. Campoli, Mining Engineer, Pittsburgh Research Center
From: Research Director, Rolla Research Center
Subject: Contact With National Laboratories

RORC personnel have limited formal contact with National Laboratories. The only person on record within the last 3 years is:

Dr. A. Fraioli
Argonne National Laboratory
Bldg. 362, Room B126
9700 South Cass Ave.
Argonne, IL 60439

D. L. Paulson



United States Department of the Interior

BUREAU OF MINES
SALT LAKE CITY RESEARCH CENTER
729 ARAPEEN DRIVE
SALT LAKE CITY, UTAH 84108-1283



March 9, 1990

Memorandum

To: Alan Campoli, Mining Engineer, PRC
From: Research Director, Salt Lake City Research Center
Subject: Contacts with National Labs

I interpreted your earlier E-mail correspondence on the subject of this memo to mean significant cooperative work not just contacts. As a result of your telephone conversation with M. B. Shirts, Assistant Research Director at SLRC, we have compiled the attached list of contacts.


S. D. Hill

Attachment

DOE Lab Contacts

<u>Lab</u>	<u>Principal Contact</u>	<u>Subject</u>
Ames Labs	Dr. Karl Geschneider	Scandium
Ames Labs	Dr. Rick Schmidt	Solvent Extraction
Ames Labs	Dr. Mike Murtha	Gallium
DOE-Pittsburgh Technology Center	Dr. Ralph Lai	Coal Flotation
Idaho National Engineering Labs	Dr. Vic Storehawk	BOM-INEL Contract
Oakridge National Labs	Dr. William McAlain	Chemical Separations
Hanford Works	Dr. Harold Ransom	Nuclear Wastes
Los Alamos	Dr. Siegfried Hecker	Materials

March 8, 1990

Previous or current contacts with DOE national labs made by individuals at
Spokane Research Center

Gen-Hua Shi, Lawrence Berkeley Laboratory
Jane C. LS. Long, Lawrence Berkeley Laboratory
Ananda Wijesinghe, Lawrence Berkeley Laboratory
Jesse Yow, Lawrence Livermore National Laboratory
Richard Thorpa, Lawrence Livermore National Laboratory
Francois Heuze, Lawrence Livermore National Laboratory
Dave Goss, U. of CA, Lawrence Berkeley Laboratory
Edna Didwall, Lawrence Livermore Laboratory
Mike Beuttner, Lawrence Livermore Laboratory

Steven Stow, Oak Ridge National Laboratory
Roger D. Spence, Oak Ridge National Laboratory

Charles Voss, Pacific Northwest Laboratories
Denis Strachan, Pacific NW Labs (Battelle)
Rai (Don) Dhanphe, Battelle Northwest Lab
Charles Kincaid, Battelle Northwest Lab
Bill Nelson, Battelle Northwest Lab
Gary L. Benson, Battelle, Northwest Lab

Joseph Jung, Sandia National Laboratory
Les Shepard, Sandia National Laboratory
Tom Blejwas, Sandia National Laboratory
Wolfgang Waweraik, Sandia National Laboratory
Barbara Luke, Sandia National Laboratory
Richard Troncoso, Sandia National Laboratory
Doug Browne, Sandia National Laboratory
Jim Metcalf, Sandia National Laboratory
Tim Talbot, Sandia National Laboratory
Joe Fernandez, Sandia National Laboratory
D. F. Ward, Sandia National Laboratory

Richard D. Roman, Argonne National Laboratory

W. P. Downs, Idaho National Engineering Laboratory
C. A. Allen, Idaho National Engineering Laboratory
Paul Wichlaaez, Idaho National Engineering Laboratory

Roger Spence, Oak Ridge National Laboratory

Donald T. Oakley, Los Alamos National Laboratory
James D. Balacic, Los Alamos National Laboratory
Paul Aamodt, Los Alamos National Laboratory
Robert E. Riecker, Los Alamos National Laboratory

Jim Low, Idaho National Laboratory
Harold J. Heydt, Idaho National Laboratory
John D. McQuary, Idaho National Laboratory



United States Department of the Interior



BUREAU OF MINES

TUSCALOOSA RESEARCH CENTER
UNIVERSITY OF ALABAMA CAMPUS
P.O. BOX L
TUSCALOOSA, ALABAMA 35486-9777

February 28, 1990

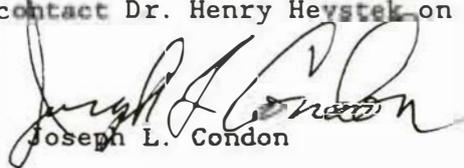
Memorandum

To: Alan A. Campoli, Mining Engineer, Pittsburgh Research Center

From: Acting Research Director, Tuscaloosa Research Center

Subject: Department of Energy National Laboratories Liaison Activity

As requested in Dr. Forshey's December 19, 1989 memorandum, TURC's history of previous interaction with the Oak Ridge National Laboratory is attached. Information on TURC's current activities is also included. We have not had contact with any other national laboratories. If you have any questions or need additional information, please contact Dr. Henry Hevstek on 222-0443.


Joseph L. Condon

Attachment

cc: John Breslin, Washington

TURC's History of Interaction with National Laboratories

In December 1984, H. Heystek attended a 2-day briefing presented by Oak Ridge National Laboratory (ORNL) personnel at Oak Ridge, Tennessee. The briefing covered research being done at ORNL on ceramic materials and included a tour of their facilities. In April 1986, K. Liles and J. Hoyer attended a similar briefing. In October 1988, J. Salsman and M. Maginnis attended and in August 1989, A. Petty and L. Sadler went.

Presently, TURC is making arrangements to participate in ORNL's "users program" that will enable the Center to utilize expensive and advanced equipment to characterize micro-phase compositions of advanced ceramic composites developed at TURC.



United States Department of the Interior

BUREAU OF MINES

TWIN CITIES RESEARCH CENTER
5629 MINNEHAHA AVENUE SOUTH
MINNEAPOLIS, MN 55417-3309

Telex: 362735 BOM TCRC UD



February 25, 1990

Memorandum

To: Alan A. Campoli, Mining Engineer, PRC

Through: Research Director, PRC

From: Deputy Research Director, TCRC

Subject: DOE National Laboratories Liaison Activity Memo of December 19, 1989--Input and Review

The first section of our response to the subject memo is the compilation of DOE National Laboratory contacts recently conducted at TCRC. These contacts comprise four general areas of interaction.

Computer Modeling of Dynamic Phenomena

Steve Crum, Geophysicist, of TCRC's Blasting Research Group has contact with Dale Preece and Billy Thorne of the Advanced Technology Division of Sandia National Laboratories, Albuquerque, NM, who are involved with computer simulation of rock motion and fragmentation of crater blasts for oil shale retort bed preparation. The rock motion code, called Distinct Motion Code (DMC), and the fragmentation code, PRONTO, have application to bench and underground blasting. The DMC is nearly completed but uses PRONTO as a first step to determine initial conditions such as flyrock velocities. The PRONTO code is still under development and the Bureau has specifically conducted several bench blasts to provide data to evaluate the code. Industry interest in this development is high, and Atlas Powder Co. has contracted with Sandia to partially fund this research.

Miscellaneous Geophysical/Rock Mechanics Areas

The TCRC Geotechnology Group maintains occasional contact with William Olsson, Senior Researcher; Dave Holcolm, Research Physicist; and Wolfgang Waversik, Distinguished Member of the Technical Staff, at the Sandia Labs. Information is exchanged on rock mechanics research and, very recently, on acoustic emission and Kaiser Effect research. At the Lawrence Livermore Labs we have had occasional contact with Francois Heuze, Head of the Geotechnical Group on rock mechanics research, and with Jeff Lytle (recently deceased) and Joe Hearst on matters of geophysical logging and tomography.

Rock Property Testing

This is an indirect interaction with a National Lab. Richard Thill, Supervisor of TCRC's Geotechnology Group, will represent the Bureau as a member of

Memo to A. Campoli, Subj.: DOE National Laboratory Liaison Activity

an organizing committee for "Interlaboratory Testing Program for Rock Properties" an activity of the Institute for Standards Research which is a subsidiary of the American Society for Testing Materials. This committee has a representative from Sandia National Laboratories. This committee is seeking support for a study of the comparison of several key rock property tests run on the same rock types at several well known rock property testing laboratories.

Program Reviews

Richard Thill and others on the BOM Rock Mechanics Steering Committee have been involved with mutual reviews of research presented in the past few years to the Geomechanics Division of the Sandia National Laboratories and the Geotechnical Group at the Lawrence Livermore Labs. This was to be an ongoing activity, but as the activity level of the Rock Mechanics Steering Committee dropped off, this interaction has declined as well. Perhaps we have each learned as much as was useful from the interaction, or perhaps this avenue of liaison should be reactivated. We propose it as an area for examination.

As for the review of the document, we will confine our comments to the capsule summaries of the Research Center's program.

An alternative/additional information package would be the mission statements that Dr. Forshey sent back to the field in his memo of September 30, 1988. These statements provide excellent summaries of the Center's capabilities. The program funding and FTE levels could be adjusted as appropriate.

Suggested changes and corrections to the TCRC summary attached to Dr. Forshey's memo of December 19 are as follows:

Corrections

- Top of page 11--Upgrading of manganese ore, not magnesium.
- Also the project in Minerals and Metals Essential to the Nation should have ...digital image size analysis of ore...

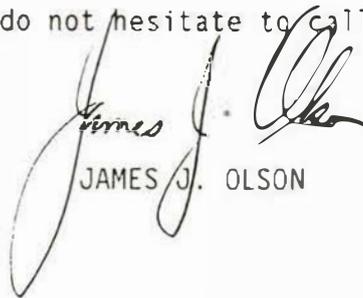
Suggestions

- Suggest replacement of the Occupational Health section with the following:
 - Computer-aided cutting system optimization
 - Linear cutting for improved production and lowered dust
 - Diesel particulate--characterization and control
 - Mine aerosols--analysis of formation and entrainment
 - Development of personal aerosol sampler

Memo to A. Campoli, Subj.: Doe National Laboratory Liaison Activity

- Add Mine Safety Systems
 - Improved dump point safety
- Suggest using the following section for Advanced Mining Systems:
 - Hydraulic fracturing to induce mine caving
 - Selective mining with water jets
 - Blast design for improved fragmentation
 - Chemically enhanced drilling
 - Novel thermal and mechanical fragmentation techniques
 - Leach solution, blasting, and fluid flow design for in situ mining of copper and manganese
 - Microwave fracturing for in situ mining
 - Seabed and Lunar mining systems

If you have any questions, please do not hesitate to call me at FTS 789-4560.


JAMES J. OLSON

cc: Associate Director--Research
Research Director. TCRC

Appendix C

**Federal Laboratory Consortium—Legislative History
and Spring 1990 Meeting**

APPENDIX C

Federal Laboratory Consortium
DelaBarre and Associates, Inc.
P.O. Box 545
Sequim, WA 98382

Contact
George F. Linsteadt
FLC Administrator
(206) 683-1828

MISSION

The need for more effective use of federally developed technology led to the establishment of the Federal Laboratory Consortium for Technology Transfer (FLC). The FLC is a service organization that provides a link between individual laboratory members and potential users of government developed technologies. It is the policy of the FLC to identify and mobilize the necessary resources to provide the environment, the organization, and the necessary technology transfer mechanisms required to facilitate the fullest possible utilization of federally sponsored research and development results by both public and private sector potential users.

FINDINGS

I attended the 1990 Spring FLC Meeting in Lakewood, CO, May 6-10, 1990. The meeting agenda is attached.

Legislative History - The FLC of today evolved from a series of technology transfer milestones; the most important of which were legislative. These milestones were:

- 1971 - The Department of Defense (DOD) formed the DOD Laboratory Consortium in 1971 to improve interlaboratory communication and find greater civilian uses for technology developed originally for military purposes.
- 1971 - Through a cooperative agreement between the National Science Foundation (NSF) and DOD, a technology liaison service was established within the NSF. The Federal Laboratory Program was within the NSF Intergovernmental Science and Research Utilization Division.
- 1974 - The consortium changed its name to the Federal Laboratory Consortium for Technology Transfer and invited all Federal agencies to participate.
- 1980 - The passage of Public Law (PL) 96-480 (the Stevenson-Wylder Technology Innovation Act) provided increased stimuli to the development and growth of the FLC. This law required each Federal laboratory to:
 - Make technology transfer part of the laboratory mission;
 - Establish a research and technology applications office (ORTA);
 - Assess research and development for potential applications;
 - Disseminate information;

- Cooperate with the National Technical Information Service (NTIS);
- Provide technical assistance upon request, especially from state and local governments.

1986 - The Federal Technology Transfer Act (PL 99-502) set further guidelines for the transfer of technology. The following is a summary of PL 99-502:

- Federal agencies may permit the director of any of its government-operated laboratories to enter into cooperative research and development agreements with private sector and other government entities; and negotiate licensing agreements on behalf of the agency.
- The FLC was formally chartered. The FLC will provide training and assistance, provide a clearinghouse for technology user requests, and facilitate interagency/laboratory communication. The FLC was provided with funding, 0.005 percent of Federal laboratory research. These contributions are not mandatory. In FY90 the FLC is funded at \$1.4 million.
- Rewards for scientific, engineering, and technical personnel of federal agencies were established.
- Retention of royalties from licensing of inventions of government-operated Federal laboratories by the agency was mandated. At least 15 percent of the royalties are to be paid to the inventor.

1989 - The National Competitiveness Technology Transfer Act of 1989 (PL 101-189) amended the Stevenson-Wylder Technology Innovation Act of 1980 and PL 99-502 of 1986. The following is a summary of PL 101-189:

- The Government-owned, contractor-operated laboratories were permitted to enter into cooperative research and development agreements with private sector and other government entities, and negotiate licensing agreements on behalf of the agency.
- Retention of royalties from licensing of invention by contractor-operated, government-owned laboratories on behalf of the agency was mandated. At least 15 percent of the royalties are to be paid to the contractor employed inventor.
- A Government-owned, contractor-operated laboratory that enters into a cooperative research and development agreement may use royalties or other income accruing to such a laboratory for payments to inventors and for scientific research and development consistent with the research and development mission and objectives of the laboratory.

Membership - Over 500 Federal government research and development laboratories and centers are represented by 160 individuals. Don Ralston is the representative for all nine Bureau of Mines Research Centers. Fourteen Federal agencies are represented, including the Departments of Agriculture, Commerce, Defense, Education, Energy, Health and Human Services, Interior, Justice, and Transportation. Other members include: the Environmental

Protection Agency, National Aeronautics and Space Administration (NASA), National Science Foundation, Tennessee Valley Authority, and Veterans Administration.

Functions - The FLC is run by standing committees made up of volunteer representatives. It holds two national meetings a year. This meeting was one of two 1990 national meetings. A monthly newsletter is published to disseminate general technology transfer news and advertise available laboratory technologies. The newsletter staff has asked me for an article on the BOM efforts to be the Federal focal point for technology transfer to the mining and mineral industries.

Demonstration projects are conducted: to develop innovative techniques for technology transfer; and to define mechanisms for applying methods in other locales. These projects along with FLC sponsored awards for excellence in technology transfer are mechanisms to foster technology transfer from Federal laboratories.

Clearinghouse - In conformance with the Federal Technology Transfer Act of 1986, the FLC Clearinghouse is a brokerage service that assists in the matching of user-technical requests with appropriate federal research capabilities. The clearinghouse is designed to link the potential user from industry, small business, local governments, or universities with a Federal laboratory person with special expertise in the user's area of interest. Once the linkage is made, the arrangements for the actual technical exchange are between the user and the laboratory.

A data base on 160 Federal laboratories is the main component of the clearinghouse. The BOM nine research centers should be individually listed as to their specific capabilities. Allan Sjöholm, Clearinghouse Manager, sent me a printout of the current BOM data, it is attached. The BOM data is dated and in some cases, misleading. Another data base, operates on a list of technical specialties. Mining is not on the list presently. Perhaps a BOM contact person should be listed under a new "mining" category.

Points of interest - Deborah L. Wince-Smith, Assistant Secretary for Technology Policy, Department of Commerce, (202) 377-1581, gave a presentation. In it she stated: the U.S. cannot take for granted our technology lead in the international marketplace, and that the 700 Federal laboratories will be the core of technology advances. These laboratories account for over half of U.S. R&D funding. Commerce sees itself as the marketing arm of the Federal technology transfer system. As the chair of the Interagency Technology Transfer Office, she told me she wants to see a copy of our final report. She feels that the focal point concept for "low" technology industry could be a valuable template.

Jonathan Root, Program Manager, National Technology Transfer Center, NASA (601) 688-1938, said he will come to the Pittsburgh Research Center in June. He desires BOM input in the planning of the \$26 million NTTC, to be housed at the Wheeling, Jesuit College, Wheeling, WV. The NTTC will be a computer data base built to match users with technology sources in the Federal laboratories. It will be similar in function to the FLC Clearinghouse, but funded at over 10 times the total FLC funding.

Glen Prosser, Oak Ridge National Laboratory, Martin Marietta Energy Systems, Inc., discussed the ORNL marketing effort. They developed a well thought out system of technology evaluation and researcher motivational awards, to facilitate technology transfer. One of the success stories he spoke of was the licensing of a solvent extraction system for rare earth processing to Molycorp Inc. This is an example of direct National Laboratory contact with the mining and mineral industry. He did say it took a significant chance meeting of an ORNL researcher with a Molycorp representative to identify the technology match. A standing BOM effort as the "focal point" could facilitate more matches between the National Laboratories and the mining and minerals industry.

Dr. Francine Jefferson, General Accounting Office, Evaluation and Methodology Division discussed GAO's effort to systematically evaluate the effectiveness of technology transfer from Federal laboratories. In her presentation she stated:

- 26 percent of the laboratories had not been given final instructions on PL 99-502 of 1986. Thus, cooperative research and development agreements have been slow in development.
- 66 percent of the laboratories have no award system for technology transfer.
- 78 percent of the laboratories responded that technology transfer success has no impact on promotion.
- 75 percent of the laboratories did not know they had an FLC representative.

Thus technology transfer initiatives from Congress have not been communicated to the laboratory directors.

Joe Allen, Director, Office of Technical Commercialization, U.S. Department of Commerce reiterated Assistant Secretary Wince-Smith's call for interagency cooperation. He also stated that Eastern European countries want and need environmental technology to combat their massive problems. Commerce feels that a foot in the door early will insure use of U.S. developed environmental technology, down the road. A task force is being formed by Commerce, should the BOM be involved in this effort? He also stressed the need for the laboratory directors to push technology transfer.

Cherri Langenfeld, Acting Director, Office of Technology Policy, Department of Energy said she was very interested in our effort. She wants to be given an advance copy of our final report. She also spoke of the need for interagency action on this issue. Line item funding for technology transfer was a necessity from her perspective.

Herb Rosen, Management Communications, Inc., (213) 204-0375 presented a training course on how to deal with the media on technology issues. I have a copy of the course notes.

William E. Loveless, Chief Editor, Inside Energy, McGraw-Hill's Technology Transfer Report, (202) 463-1660 wants an article on our effort to be the focal point within the Federal laboratory system.

Richard A. McComb, Chief, Implementation Division, Federal Highway Administration, McLean, VA, (703) 285-2349 told me that the FHA has seen a dramatic increase in underground aggregate mining across the country. These mines have sprung up due to the resistance to surface pit operations by environmental groups. He sees a need to devise ground control and mining method procedures for these mines, as many are designed by engineers unfamiliar with underground excavation.

Dr. John A. Breslin, Chief of Staff, Research, BOM, Washington Office attended this FLC conference as part of an executive training course. Dr. Breslin and I had about 4 hours of conversation on this effort. He seemed to be impressed with what we have accomplished. We discussed implementation schemes for establishing the BOM as the "focal point" for technology transfer to the mining industry. He feels that a decentralized effort spread across the nine BOM Research centers could be the best approach. He would like to have an opportunity to review the report with Don Ralston prior to its release.

RECOMMENDATIONS

The FLC is one of many tools to advertise the BOM efforts in this area. The BOM segment of the FLC Clearinghouse laboratory data base should be reviewed and updated. A representative from each laboratory, should be considered in place of the current one representative format.

Consideration should be given to writing an article on the "focal point" concept for both the FLC Newsletter and McGraw-Hill's Technology Transfer Report.

Deborah Wince-Smith, Assistant Secretary for Technology Policy, Department of Commerce and Cheri Langenfeld, Acting Director, Office of Technology Policy, Department of Energy should be kept informed of developments in this area. They both were very supportive of this effort and felt it could be a template for interagency interaction.

The BOM should get involved in the planning of the National Technology Transfer Center, through Johnathan Root, NASA.

Dr. John Breslin and Don Ralston should participate in the preparation of the final report on this effort.

FLC SPRING 1990 MEETING AGENDA

COMPETITIVENESS -- IS GOVERNMENT TECHNOLOGY CONTRIBUTING?

May 7-10, 1990

MONDAY, MAY 7, 1990

8:30AM	12:30PM	FLC Fundamentals - Training, Pre-Registration Required
12 Noon	5:00PM	Registration Desk Open
1:00PM	2:30PM	Teleconferencing I - Training, Pre-Registration Required
1:00PM	5:00PM	Regional Meeting: Mid-Atlantic Region
2:30PM	5:00PM	Regional Meetings: Southeast Region; Mid West; Mid Continent; and Far West Regions
6:00PM	10:00PM	Regional Meeting: Northeast Region

TUESDAY, MAY 8, 1990

7:30AM	5:30PM	Registration Desk Open
7:30AM	8:30AM	Coffee service ONLY outside Meeting Room
8:30AM	9:30AM	SESSION I - Welcome & Keynote Chair.: Dana Moran, Solar Energy Research Institute. Welcome from Colorado Governor Romer Keynote from the President's Council on Competitiveness
9:30AM	10:00AM	Break
10:00AM	12Noon	SESSION II - How Effectively Is Government Technology Contributing? - The Industrial Perspective Chair.: Dick Chapman, Chapman Research Group Chrmn. Chapman has gathered representatives from large and small industry, and capital development experts to provide brief statements which will evaluate laboratory programs, with clear descriptions of problems levels of satisfaction, weaknesses and strengths in the processes, and specific recommendations. Presentations will be short, to the point, and designed to stimulate lively discussion. Plenty of time will be devoted to questions and answers.
12Noon	1:30PM	Luncheon
1:30PM	3:30PM	SESSION III - The Federal Laboratory Perspective Co-Chairs: Syl Houston, Western Executive Development Center; and Daniel Williams, DOE-Ames Laboratory Designed in a point-counterpoint format, after describing the results of the GAO survey of federal laboratories, the labs will have the same opportunity the private sector had in the previous session. In addition to a self-evaluation, they will critique industrial participation in technology transfer. In short presentations, issues including means of enhancing effectiveness of the laboratories' programs and the problems imposed by the bureaucracy.
3:30PM	3:45PM	Break
3:45PM	5:30PM	Agency Meetings (Air Force, Army, DOE, NASA, Navy)
5:30PM	7:00PM	Welcome Reception (on-site) In addition to the opportunity to discuss ideas and concerns with colleagues, the computers will be working overtime to record any comments inspired by the evening's atmosphere and discussion.



Federal Laboratory Consortium

May 15, 1990

Mr. Alan Campoli
US Bureau of Mines
PO Box 18070
Pittsburgh, PA 15236

Dear Alan;

I enjoyed meeting you at the FLC Semi-Annual Meeting in Lakewood, CO. Sorry we did not get a chance to interact more.

As per your request I am sending you a copy of the Bureau of Mines' profile from our Resource Directory.

Del plans to go out with the annual up date questionnaire in about a month or so.

If you have any questions just give me a call.

Sincerely,

Allan Sjoholm
FLC Clearinghouse Manager

TR 9005-01044 Bureau of Mines Resource Dir. Profile
Enclosure: Directory Listing
cc: Dr. Loren Schmid

FLC CLEARINGHOUSE

DelaBarre & Associates, Inc. • 1007 5th Avenue, Suite 810 • San Diego, CA 92101 • (619) 544-9033 • FAX (619) 544-9524

ALLAN A. SJOHOLM

CRTYPE KEY WORDS

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ADMINISTRATION AND MANAGEMENT
      R&D ADMINISTRATION AND TECHNOLOGY TRANSFER
P      RESEARCH MANAGEMENT
S      TECHNOLOGY TRANSFER
DETECTION AND COUNTERMEASURES
S      SEISMIC DETECTION
EDUCATION AND TRAINING
      TECHNICAL
P      HEALTH AND SAFETY
ENGINEERING
      METALLURGICAL (See: MANUFACTURING TECHNOLOGY; AND
P      MATERIAL SCIENCES)
P      MINING
      SAFETY
S      ACCIDENTS, NON TRANSPORTATION
S      FIRE
MATERIALS SCIENCES
      CERAMICS, REFRACTORIES, AND GLASS
S      CERAMIC COATING
      CORROSION AND CORROSION INHIBITION
S      CORROSION ELECTROCHEMISTRY
S      CORROSION INHIBITORS
S      CORROSION OF METALS
S      CORROSION RESISTANT COATINGS
S      RUSTING
S      UNWANTED CHEMICAL REACTION
      IRON AND IRON ALLOYS
S      EXTRACTIVE METALLURGY
S      REFINING
      NONFERROUS METALS AND ALLOYS
S      EXTRACTIVE METALLURGY
S      REFINING
      REFRACTORY METALS AND ALLOYS
S      EXTRACTIVE METALLURGY
S      REFINING
NATURAL RESOURCES AND EARTH SCIENCES
      MINERAL INDUSTRIES
P      COAL MINING
S      COAL PREPARATION
P      EXPLORATION GEOPHYSICS AND SEISMOLOGY
S      METALS EXPLORATION AND MINING
P      MINE SAFETY
P      MINERAL ECONOMICS
P      NATURAL RESOURCES STUDIES
P      RESERVES
S      UNDERWATER AND CONTINENTAL SHELF MINING
P      NATURAL RESOURCE SURVEYS

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Appendix D

Argonne National Laboratory (ANL)

APPENDIX D

Argonne National Laboratory
9700 South Cass Avenue
ES 362
Argonne, IL 60439

Contact
Donald O. Johnson
Reclamation Engineering and Geosciences
Energy Systems Division
(708) 972-3392

MISSION

Argonne National Laboratory (ANL) conducts applied research and engineering development in nuclear fission and other energy technologies and scientific research in basic physical and life sciences. Research and development at ANL links technology base research with engineering development, from concept stages to application. Primary program areas: Nuclear energy, basic energy sciences, conservation and renewable energy, biological and environmental research, and superconductivity.

FINDINGS

Donald O. Johnson, Manager, Reclamation Engineering and Geosciences Group, Energy Science Division, hosted my March 22, 1990 visit to ANL. Brian T. Frost, Director, Technology Transfer Center, gave me an overview of ANL. ANL is a nonprofit, multipurpose laboratory focusing on basic research in the physical, biological, and environmental sciences, and on technology-directed research in fission, fossil, and fusion energy as well as conservation and renewable energy. The main facilities are located on a 1,700-acre site near Chicago, IL. A second 500-acre site, located at the Idaho National Engineering Laboratory near Idaho Falls, ID, is devoted to fission reactor technology. ANL is a government-owned, contractor-operated facility managed by the University of Chicago for the DOE. ANL employs 4,000 people and operates on a budget of \$300 million a year. Approximately 80 percent of the budget is funded by the DOE; the other 20 percent comes from a wide array of Federal agencies and private concerns.

ANL comprises four research areas: energy, environment, and biology; physical research; reactor engineering; and the recently formed advance photon source, which, when constructed, will operate a 7 GeV synchrotron x-ray source facility, scheduled to be in operation by the year 2000.

ANL seeks to make its facilities and expertise available to industry through: cooperative research and development, contract research and development on a best-effort and cost-reimbursable basis, and licensing of patents. Also, the University of Chicago operates the Argonne National Laboratory/University of Chicago Development Corporation (ARCH) to facilitate the commercial development of intellectual property emanating from the university and ANL.

There are 16 Divisions at ANL. I met with representatives of the Energy Systems Division, Experimental Breeder Reactor Division, Chemistry Division, Chemical Technology Division, Materials Components Division, and Materials

Science Division. These discussions made it clear to me that there is much overlap between the mission at multiprogram National Laboratories. This is especially true for the Brookhaven and Pacific Northwest Laboratories according to the comments of most of the researchers. The common complaint was that whenever there is opportunity to get new work started, representatives of all three labs show up with individual proposals.

The Materials Science Division and Materials Components Division representatives spoke of contacts with BOM representatives from the Albany and Tuscaloosa Research Centers. My problem is that I don't know enough to differentiate between their work and the research at Mound, Brookhaven, and Ames Laboratories. They all do the same types of things; scanning electron microscopes, destructive strength, nondestructive evaluation, and the like.

The Chemistry Division and Chemical Technology Division representatives spoke of many basic research projects being conducted in areas similar to BOM research. This was also true for the material science representatives. I was given many publications that could be sent to the BOM materials science staff engineer who could route them to knowledgeable BOM personnel.

Dr. E. Philip Horwitz, Chemical Separation Group, had a very specific idea for minimizing metal oxide dissolution from metal mine tailings. Thermally unstable complexants (chemicals that break down at room temperature) would be applied to tailing piles. The chemicals react with the surface of the metal oxides and prevent them from going into solution with water; thus, the metals never get into surface waters. He wants the BOM to contact a mine operator and get him samples to test.

Dr. Kenny C. Gross, Experimental Breeder Reactor Division, is one of the best expert systems people in the DOE laboratory system. He designs the systems that safeguard fission reactors. Dr. Gross is very interested in discussing ANL and BOM approaches to expert system creation and use.

Richard D. Doctor, Energy Systems Division, has done some superconducting magnetic separation work on high-sulfur coal. He has presently unused, large-scale magnets and a great desire to speak with the Albany Research Center researchers doing the superconducting magnetic field separation of minerals research. He has developed a very interesting gravity drop system that could be used in a large-scale pilot plant. I have a paper he wrote on the system. It would be interesting to see if the Albany people know of this work.

The Reclamation Engineering and Geosciences Group, managed by Donald Johnson (our contact), is doing research work for the Gas Research Institute on pipeline environmental effects, the DOD on military base environmental effects, mine land reclamation for the Bureau of Land Management, and foreign land management work for the Agency for International Development. Mr. Johnson is a high-energy type, who was trained as a geologist.

A meeting with Norman F. Sather, Director, Energy Systems Division, concluded my visit to ANL. He just returned from a "Support for the U.S. Environmental and Work Management Industry by the DOE Laboratories" meeting at Los Alamos. He said Senators Domenici and Chafee chaired the meeting, attended by over 130 industry and DOE Laboratory representatives. He gave me a copy of the agenda and a list of the attendees. His impression of the meeting was very similar to your impression of the March 1989 Pittsburgh mining industry meeting. Much

discussion of the great wealth of DOE developments, but very little on how to access technologies.

RECOMMENDATIONS

It is recommended that expert-to-expert contacts be immediately developed between the BOM and the Argonne National Laboratory in the following areas:

Expert Systems--Dust Control and Ventilation, PRC
Superconducting magnetic ore separation--Albany Research Center, and
Metal oxide ground water pollution--Environmental Technology, PRC.

The immediate contacts should be initiated with a call from the appropriate BOM expert to the appropriate ANL expert, after Dr. Ken Sacks, Deputy Research Director, PRC, has set up the interaction through Donald Johnson.

ANL is very similar to the Brookhaven National Laboratory. They both are very large and diverse, with a very broad mission. My visits to labs of this nature touch on a very small portion of the work conducted. A mechanism must be devised to foster ongoing interaction with these large multiprogram labs.

ARGONNE NATIONAL LABORATORY

9700 SOUTH CASS AVENUE, ARGONNE, ILLINOIS 60439

John Murphy - PR

January 25, 1990

Mr. David R. Forshey *DR*
Associate Director, Research, W0
Bureau of Mines
U.S. Department of the Interior
2401 E Street, N.W.
Washington, DC 20241

Reference: Letter of December 19, 1989 from D. R. Forshey to A. Schriesheim

Dear Mr. Forshey:

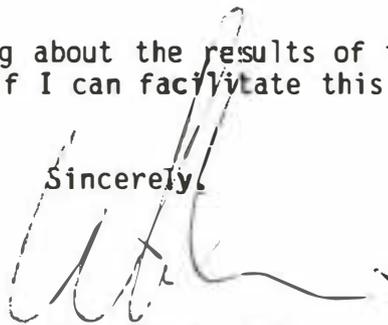
Thank you for your letter of December 19 describing the efforts of the Bureau of Mines to investigate possibilities of serving as a liaison between the national laboratories and the U.S. minerals industries. These efforts appear to complement the recent emphasis on technology transfer at Argonne and the other national laboratories.

In response to your request, I am naming Donald O. Johnson of our Energy Systems Division as contact point for communication on this issue. He can be reached at the following address and telephone number:

Donald O. Johnson
ES-362
Argonne National Laboratory
Argonne, Illinois 60439
708/972-3392

I will look forward to learning about the results of this initiative by the Bureau of Mines. Let me know if I can facilitate this promising process in any other way.

Sincerely,



Alan Schriesheim
Director

SB:ajl
cc: D. Johnson
N. Sather



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



March 29, 1990

Mr. Donald O. Johnson
Reclamation Engineering and Geosciences
Energy Systems Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

Dear Mr. Johnson:

Thank you for hosting my March 22, 1990, visit to the Argonne National Laboratory. You displayed a great deal of energy and enthusiasm for ANL and the work of your Reclamation Engineering and Geosciences Group. My visit was very informative due to the many ANL personnel who were so generous with their time and expertise.

The possibility of immediate Bureau of Mines to ANL contact in the areas of expert systems, superconducting magnetic ore separation, and metal oxide ground water pollution prevention, should be considered. These contacts should be initiated after Dr. Ken Sacks, Deputy Research Director, Pittsburgh Research Center, has set up the interaction through you.

I hope your visit to the dentist went well.

Thank You,

Alan A. Campoli
Mining Engineer

Appendix E

Brookhaven National Laboratory (BNL)

APPENDIX E

Brookhaven National Laboratory
Building 815
Upton, NY 11973

Contact
Dr. Keith W. Jones
Department of Applied Science
FTS 666-4588
(516) 282-4588

MISSION

The Brookhaven National Laboratory (BNL) conceives, develops, constructs, and operates complex research facilities for the study of fundamental properties of matter. BNL conducts basic and applied research in technology base areas, supports research facilities, and establishes important new directions for research. Major disciplinary strengths at BNL are high-energy, nuclear, and solid-state physics; chemistry; and biology. Primary program areas: high-energy physics, basic energy sciences, biological and environmental research, and nuclear physics.

FINDINGS

BNL is a multiprogram laboratory, which carries out basic and applied research in the physical, biomedical and environmental sciences, and in selected energy technologies. The laboratory is managed by Associated Universities Inc. (AUI), under contract with the Department of Energy (DOE). AUI is a non-profit research management organization sponsored by nine northeastern universities: Columbia, Cornell, Harvard, Johns Hopkins, Massachusetts Institute of Technology, Princeton, University of Pennsylvania, University of Rochester, and Yale. BNL does not perform any weapons research and development. Thus, it has an open campus like atmosphere over the 5,265 acre site.

My contact, Dr. Keith Jones, Head Atomic and Applied Physics Division, designated by Dr. N. T. Samios, BNL Director, was not available due to the illness of his mother. Dr. Allen N. Goland, Deputy Chairman Department of Applied Science provided me with an overview of BNL and a selected tour of the facility, on March 13, 1990.

Dr. William Marcuse and his assistant Frank J. Salzano, of the Office of Research and Technology Applications Department gave me an overview of BNL technology transfer. BNL has an impressive history of industry commercialization of laboratory developments. Dr. Marcuse mentioned the National Energy Technology Transfer Center which will be built in Wheeling, WV. He says Senator Byrd's recently passed bill will enable this facility. It in theory would do just what we are attempting to do. This situation should be investigated with our Washington office personnel.

Allan Kolker, Geologist, discussed his work on the geochemistry of fluid evolution in coal formation. The work employed trace element microanalysis of Illinois Basin coals by synchrotron radiation induced X-ray fluorescence. Mark C. Rivers presented his study of sulfide gold deposits using the same

technology. Dr. Rivers is employed by the University of Chicago and his work was funded by the U.S. Geological Survey. He says much platinum group metal value is thrown away because the metals are hidden in clay deposits within the ore. He thinks the feasibility of mineral processing to capture the lost metals should be investigated.

Dr. William Thomlinson, Experimental Program Coordinator for the National Synchrotron Light Source (NSLS) gave me a tour of the facility. The NSLS is the world's most powerful and versatile source of synchrotron radiation providing intense beams of X-ray (used in the above studies) and ultraviolet light for research in physics, chemistry, biology, and other technologies.

The NSLS consists of two electron storage rings. Synchrotron light is the electromagnetic radiation emitted by rapidly moving charged particle when it moves in a curved path. It is produced when electrons are circulated in closed orbit particle accelerators. The radiation emitted by electrons as they travel around the rings is admitted to experimental areas through window-like beam ports in the concrete tunnels housing the storage rings.

The vacuum ultraviolet (VUV) ring operates at electron energy of 750 million electron volts (MeV) and is used for surface science studies of basic molecular physics. The X-ray ring, used for internal structure analysis, operates at 2.5 giga electron volts (GeV) to optimize radiation from 1 keV to 10 keV. The 16 VUV ports and 28 X-ray beam ports accommodate over 400 users representing 52 separate institutions. The radiation is free, but user groups must provide the hardware away from the beam ports. In return for the radiation, the user groups must give 25 percent of beam time to the general scientific community. The NSLS runs 24 hours a day, 7 days a week.

The BOM was encouraged to do X-ray diffraction geologic studies on the NSLS. The cost would be minimal according to Dr. S. Barron, Associate Director for Applied Programs. What minimal means in dollars would have to be investigated. BNL stresses the participation of outside researchers. Meaning BOM geologist would be trained in how to conduct NSLS, by people like Dr. Mark Rivers, and they must do the experiments themselves. This would be a wonderful opportunity to educate BOM geologists in the operation of this one of a kind device.

Dr. C. John Suen gave me a presentation on numerical modeling of long-term nuclear waste disposal sites. This hydrological modeling of contaminant transport takes into account container break down and ground water flow patterns. This work could impact the leaching of surface heavy metals from soils surrounding old smelting facilities, presently studied by the Spokane Research Center.

Mr. Meyer Steinberg discussed underground coal hydro-gasification process developed by BNL, under DOE contract. The Morgantown Energy Technology Center has responded negatively to the process. He also discussed BNL developed pumpable roof bolts. They were tried commercially in the 1970's by EIMCO. Despite the fact that they failed commercially, this indicates BNL has had past success transferring developments to the mineral industries. Steinberg is working on "mild gasification" of coal for the Morgantown Energy Technology Center. "Mild" because it is conducted at "low" temperatures.

Mr. Larry Kukacka gave me a presentation of BNL work on composite materials. High temperature coatings on steel and high temperature concrete for geothermal power stations have been developed. Much work has been done on resins for pumpable adhesives. Many of the in-mine grouting companies have been in touch with BNL on this issue. BNL would like BOM to help organize a workshop for geotechnical grouting concerns. Mr. Kukacka thinks he can provide assistance on the Environmental Technology Group's (PRC) stream sealing work. The development of specialized concrete mixtures has had past involvement with William McVay, of the Spokane Research Center.

Mr. Sam Moris discussed biomedical health risk analysis research. BNL personnel testified during the hearings leading to the radon in mines legislation. He would like to talk to BOM researchers working on injury prevention. The PRC researchers conducting bio-mechanical analysis of human lifting would be a good initial contact.

Dr. Jerome I. Barancik has been contacted by the National Coal Association and the United Mine Workers Union about his information system for industrial safety to improve quality, productivity, and competitiveness work. His is a co-worker of Mr. Moris in the Injury Prevention and Analysis Group of the Department of Applied Science.

Dr. Eugene T. Premuzic has done some impressive pioneering work on the role of biotechnology for detoxification. The geothermal industry produces a residual waste, referred to as brine sludge. The sludge is disposed of in hazardous waste disposal sites at considerable cost. Chromium, copper, manganese, zinc, and other metals are present in the sludge in low-grade ore quantities. Acidophilic microorganisms have been chosen as active agents for the solubilization of metals in sludges. BNL has performed bench scale biological waste treatment plant tests. Dr. Premuzic predicts full-scale plants will be operating by 1995. This work could be of critical importance to the Environmental Technology program of the BOM. The Environmental Technology Group, PRC, should contact Dr. Premuzic on this issue.

Dr. S. Barron, Associate Director for Applied Programs, met with me to close my visit to the BNL. He was very supportive of our effort. He mentioned BNL is going to construct acid water treatment bogs on site. He was unaware of the Environmental Technology Group's work on this issue. The Environmental Technology Group should contact Dr. Barron to discuss a possible cooperative effort on the design of this experiment.

RECOMMENDATIONS

It is recommended that expert-to-expert contacts be immediately developed between the BOM and the Brookhaven National Laboratory in the following areas:

- X-ray diffraction geologic studies - GMC, PRC
- Bio-medical health risk - MSHE, PRC
- Biotechnology for detoxification - ET, PRC
- Composite materials - ET, PRC
- Acid water treatment with bogs - ET, PRC

The BNL has a very broad mission. They have been in too many areas over the years to list. The areas of interest can change as rapidly as the political

winds that drive them. For this reason, the BNL should be the subject of an ongoing interaction with the BOM and mining and mineral industry groups.

The immediate contacts should be initiated with a call from the appropriate BOM expert to the appropriate BNL expert, after Dr. Ken Sacks, Deputy Research Director, PRC, has set up the interaction through Dr. Jones. Continued development of the relationship should be left in the hands of the two experts.

John Murphy



BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.

Upton, Long Island, New York 11973

(516) 282-3037
FTS 666-3037
FAX: 516-282-4130

Department of Applied Science

January 17, 1990

Dr. David R. Forshey ^{DF}
Associate Director--Research, WO
Bureau of Mines
US Department of the Interior
2401 E Street, NW
Washington, DC 20241

Dear Dr. Forshey:

I was pleased to learn that the Department of the Interior and its Bureau of Mines were interested in surveying the potential for interactions between the DOE National Laboratories and the minerals industry. I enclose two publications and an abstract which may show one area where Brookhaven facilities have already made a contribution. In order to assist you in your assessment of the Brookhaven capabilities, I have appointed Keith Jones of this Department as contact person. He can be reached at:

Dr. Keith W. Jones
Building 815
Department of Applied Science
Brookhaven National Laboratory
Upton, NY 11973
Telephone: 516-282-4588; FTS 666-4588
FAX: 516-282-7905
BITNET: JONES@BNLCL1

Sincerely yours,

Leon Petrakis
Chairman

LP:lmb

Enclosures 3

Copy to N. P. Samios



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



March 19, 1990

Dr. Keith W. Jones
Brookhaven National Laboratory
Building 815
Upton, NY 11973

Dear Dr. Jones:

I was very sorry to hear about your mother's illness. Events such as this should take precedence over work activities. I wish her a speedy recovery.

My visit to the Brookhaven National Laboratory (BNL), on March 12, 1990, was very informative and fruitful despite your absence. This was mainly due to the efforts of Dr. Allen N. Goland. My thanks to Dr. Goland, Deputy Chairman, Department of Applied Science, and the many other BNL personnel who were so generous with their time and expertise. The visit opened my eyes to the many ways that BNL has and could be of great benefit to the U.S. mining and minerals industries.

The possibility of immediate expert-to-expert contacts in the areas of X-ray diffraction geologic studies, biomedical health risk assessment, composite materials, and biotechnology for detoxification should be considered. These BNL to Bureau of Mines (BOM) contacts need not be elaborate efforts. They should be initiated with a call from the appropriate BOM personnel to the appropriate BNL expert, after Dr. Ken Sacks, Deputy Research Director, Pittsburgh Research Center has setup the interaction through you. Continued development of the relationship should be left in the capable hands of two technical representatives.

Alan A. Campoli
Mining Engineer

cc: Dr. Goland
HKSacks
AACampoli
PRC Files

Appendix F

Idaho National Engineering Laboratory (INEL)

APPENDIX F

Idaho National Engineering Laboratory
785 DOE Place
Idaho Falls, ID 83402

Contact
Mr. Richard B. Loop
Project Manager, Materials Engineer
(208) 526-0350

MISSION

Idaho National Engineering Laboratory (INEL) is a multipurpose defense-programs laboratory. Historically a leader in the DOE's reactor technology programs, INEL conducts applied research and development to support DOE's mission. INEL also maintains, for the Federal Government, the capability to provide independent scientific advice, and technical verification and validation in areas of expertise. INEL provides use of its unique facilities for the benefit of members of the technical community, cooperates with personnel in universities and industry to aid in the education of scientists and engineers, and transfers technology to the public and private sectors.

FINDINGS

Mr. Richard B. Loop hosted my April 17, 1990, visit to INEL. Richard, a DOE project manager and a materials engineer, provided me with an overview. INEL is situated on 890 square miles of the southeast Idaho desert. Administered by the DOE Idaho Operations Office, INEL is operated by eight contractors on a budget of \$900 million in FY91. EG&G, Westinghouse Electric, Rockwell, Argonne National Laboratory, and Westinghouse Idaho Nuclear are among the contractors. A total of 11,000 people are employed in Idaho by INEL. There are INEL sites in New York, Montana, Colorado, and at the Three-Mile Island nuclear plant. Defense work funding is \$223 million in FY91. Work for others funding including the \$4 million from the BOM, is \$207 million in FY91. INEL efforts can be divided into six areas: nuclear safety research, reactor development, reactor operations and training, defense-related materials production, waste management and technology development, and energy technology and conservation programs.

George L. Vivian, Bureau of Mines Technical Project Officer for BOM Contract J0134035 with INEL, sat in on the days' meetings. This work is divided into two areas, Production Technologies and Conservation/Substitution Technologies. Production Technologies tasks, directed at developing advanced extraction technologies, are Biologically-Assisted Minerals Processing, Reactions in Thermal Plasmas, Inorganic Membrane Research, Super Critical Fluids for Soil Decontamination, Application of Ultrasound in Extractive Metallurgy, Biooxidative Curing of Refractory Gold Ore Heaps Prior to Cyanide Leaching, and Cyclone Reduction of Taconite Particles. Conservation/Substitution Technology tasks, directed toward establishing the technical base which will lead to the development of advanced materials and thus reduce U.S. dependence on foreign supplies of vulnerable and strategic materials, are Rapid Solidification Powder Processing of Stainless Steels, Joining of Silicon Nitride-Based Ceramics, Noncontacting Nondestructive Evaluation for Materials Characterization, Substitute Catalysts for Platinum, Thermal Plasma Spray

Processes, Wear-Resistant Materials, and Inorganic Polymer Structural Materials.

George says four new project areas will be added in May 1990: Laser-Assisted Electrochemical Processing, Nanostructure Materials, Surface Research, and Intelligent Control of Nonlinear Processes.

Mr. Vivian reports to Bob Caplin, Chief of Mineral and Materials Science, BOM, WO. The Salt Lake City, Reno, Albany, and Tuscaloosa Research Centers are all involved in the BOM INEL work. Mr. Murphy, Dr. Wade, Dr. Forshey, and many other BOM representatives have been briefed on this work.

Mr. Gerry G. Streier, Manager, Office of Research and Technical Applications, really loved the BOM Technical Transfer "pull" idea. He feels that starting small with two or three mining-knowledgeable professionals is the way to go. This would allow for an incubation period, that would not be there if major money was spent on this issue. Gerry believes that the focal point concept could become a template for other industries.

Dr. Vic Storhok, EG&G Manager, Science and Technology Division, led the remainder of the days' discussions. Pat Dugan and Pete Pryfogel described the INEL Biotechnology efforts in sorption, leaching, precipitation, and methane destruction. Of particular interest is Dr. Dugan's idea of membrane wall oxidation of methane in mine ventilation air. The selected organisms convert methane to carbon dioxide and water. He says membrane walls could handle the less than 2 percent methane maximum found in mine ventilation air. If this is the case, ventilation power costs could be significantly reduced in deep gassy mines. A PRC ventilation researcher should contact Dr. Dugan.

Dr. Storhok led me on a tour of INEL materials lab. The lab is noted for surface material science. INEL has developed a sonic vibration/laser measurement technique for nondestructive testing. A sonic pulse vibrates the specimen and a laser interference measures the reaction. This technique will be employed to evaluate space shuttle re-entry tile adhesion. Dr. Forshey was informed of the possibility of using this scheme for wire rope testing.

Frank Felicione discussed bioremediation of waste water streams containing metal ions and biological metal stripping of plated shapes.

Dr. William E. Harrison, Manager, Geosciences Group, and three of his employees discussed the INEL work in Bioremediation and Hydrological Modeling, Geochemistry, Hydrology, Geology, and Seismology. The Geosciences Group blends a selection of earth sciences fields with emphasis on groundwater hydrology, vadose zone hydrology, numerical modeling, regulatory compliance, and geologic hazard assessment. Field oriented studies with extensive experience in sampling, characterization, and monitoring of hazardous, and radioactive waste sites.

George Vivian noted that Albany Research Center developed a chemically resistant cement that is under consideration for use in nuclear impoundments. This is an example of how two-way communication between the BOM and DOE laboratories can benefit DOE research.

INEL research has won many awards. In 1987, INEL received an IR-100 award for a BOM-sponsored metallurgy breakthrough. The die-target process for the

consolidation of rapidly solidified metal alloy powders reduces the tensile components of the dynamic stress wave, thereby producing crack-free consolidated metal shapes.

RECOMMENDATIONS

INEL, like Brookhaven, Oak Ridge, and Argonne, is a multiprogram National Laboratory with a wide and constantly changing mission. It should be the subject of an ongoing BOM technology transfer "pull" mechanism. Despite the presence of George Vivian and the numerous visits by BOM personnel, the methane destruction wall idea was only brought to light by my visit. This illustrates the need for a more systematic search procedure. Dr. Dugan should be contacted by PRC Dust Control and Ventilation personnel, to help him evaluate the feasibility of this idea.



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



April 26 , 1990

Mr. Richard B. Loop
Idaho National Engineering Laboratory
Project Manager - DOE
785 DOE Place
Idaho Falls, ID 83402

Dear Mr. Loop:

Thank you for hosting my April 17, 1990, visit to the Idaho National Engineering Laboratory (INEL). My visit was very informative due to the many INEL personnel who generously shared their time and expertise. George Vivian's presence makes INEL uniquely close to the Bureau of Mines. As the TPO on Bureau-sponsored INEL research, he has developed an intimate knowledge of INEL research. Dr. Pat Dugan's biological methane destruction in mine ventilation air idea should be investigated. A Bureau ventilation researcher will contact Dr. Dugan after Dr. Kenneth Sacks, Deputy Director, has discussed this interaction with you.

Sincerely yours,

Alan A. Campoli
Mining Engineer



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRAN'S MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



May 31, 1990

P. R. Dugan, Director
Center for Bioprocessing Technology
Idaho National Engineering Laboratory
P.O. Box 1625
Idaho Falls, ID 83415

Dear Dr. Dugan:

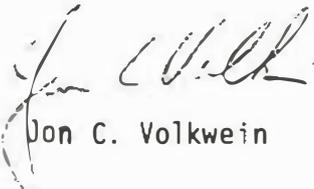
I was interested to hear of your application of methanotrophic microorganisms for mitigating methane hazards in underground coal mines in your May 11 letter to Mr. Campoli. As you are aware from Mr. Campoli and our previous conversations, the Bureau is interested and has initiated work in the possible application of methanotrophs in mining.

We have been experimenting with a mixed methanotroph culture provided by Gemini Biotechnology Ltd. under contract to CANMET. The methane reduction results from *Methylomonas methanica* described in your August 1990 ACS preprint seem similar. We have a gas phase bioreactor design, which simulates a practical underground coal mine application of methanotrophs. We would be pleased to cooperate on a scale up of this idea and further collaborate with other industrial partners.

Combining INEL and Bureau of Mines expertise in a cooperative effort should enhance the evaluation of the use of methanotrophs in mining. There are a number of technical areas which will need to be addressed. I propose a meeting at INEL to plan the direction of a cooperative effort.

Please call me when you have some convenient times for a visit. My FTS phone number is 723-6689, commercial (412) 892-6689.

Sincerely,



Jon C. Volkwein

cc: GLVivian, BOM
SONewman
JNMurphy
HKSacks
FNKissell
EDThimons
AACampoli
DCVfiles

Appendix G

Lawrence Berkeley Laboratory (LBL)

APPENDIX G

Lawrence Berkeley Laboratory
University of California
Berkeley, CA 94720

Contact
Dr. Pepi Ross
Director of Technology Transfer
(415)486-5602

MISSION

Major roles of the Lawrence Berkeley Laboratory (LBL) are to perform multidisciplinary research in the general, energy, and life sciences; develop and operate unique national experimental facilities; educate and train the next generation of scientists and engineers; and foster productive relationships between LBL research programs and industry. The world's most advanced electron microscopes and heavy ion particle accelerators are operated at LBL and are available for use by industrial and other researchers. Primary program areas: nuclear sciences, biology and medicine, conservation and renewable energy, high energy physics, materials and chemistry, and earth sciences. LBL is one of the high-temperature superconductivity research centers designated to facilitate transfer to the private sector and focus superconductivity research developed by all of the National Laboratories involved with this research.

FINDINGS

LBL is operated by the University of California for the DOE. Annual funding is approximately \$170 million for LBL, supporting a staff of approximately 2,600.

LBL was not visited. However, Dr. Ross expressed interest in an ongoing BOM effort, if one is established.

RECOMMENDATIONS

LBL is a multiprogram DOE National Laboratory, as such, it represents a significant source of technology for the mining and mineral industries. It should be the subject of an ongoing BOM "focal point" effort.



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



May 31, 1990

Dr. Pepi Ross
Director of Technology Transfer
Lawrence Berkeley Laboratory
Building 19, Room 1076
Berkeley, CA 94720

Dear Dr. Ross:

As we discussed, it is unfortunate that I cannot visit Lawrence Berkeley Laboratory at this time. However, the Bureau of Mines is considering putting in place an ongoing effort to act as the "focal point" for Federal laboratory technology applicable to the mining and mineral industries. LBL could definitely enhance such an effort. I will keep you informed of developments on this issue.

Sincerely,

Alan A. Campoli
Mining Engineer

cc: ✓ AACampoli
HKSacks
PRC Files

GMC: AACampoli:jed:5/31/90:(412)892-6558

Appendix H

Lawrence Livermore National Laboratory (LLNL)

APPENDIX H

Lawrence Livermore National Laboratory
University of California
Livermore, CA 94550

Contact

Dr. Francois Heuse
Head of Geomechanics Group
(415) 423-0363

MISSION

Lawrence Livermore National Laboratory (LLNL) was established in 1952 to do research on nuclear weapons and magnetic fusion energy. Since then, LLNL has added other major programs, including laser fusion and laser isotope separation, biomedical and environmental sciences, and applied energy technology. Research is conducted on the free-electron laser for the Strategic Defense Initiative Organization. These programs, in turn, require research in basic scientific disciplines, computer science and technology, engineering, and physics. LLNL has particular strengths in fields such as scientific and engineering software, biotechnology, advanced materials, precision engineering, laser and electro-optic technology, microelectronics, and instrumentation.

FINDINGS

LLNL is operated by the University of California for the DOE. Annual funding and staffing are approximately \$925 million and 8,500.

LLNL was not visited. However, Dr. Heuse expressed interest in an ongoing BOM effort, if one is established.

RECOMMENDATIONS

LLNL is a multiprogram DOE laboratory, as such, it represents a significant source of technology for the mining and mineral industries. It should be the subject of an ongoing BOM "focal point" effort.



AKS

John Murphy
Lawrence Livermore National Laboratory

January 19, 1990

Dr. David R. Forshey *JH*
Associate Director of Research, WO
U. S. Department of the Interior
Bureau of Mines
2401 E Street, NW
Washington, DC 20241

Dear Dr. Forshey:

This is in response to your request that we identify a point of contact at the Lawrence Livermore National Laboratory to facilitate communication on technology transfer related to the U.S. minerals industry.

Gordon T. Longerbeam, Program Leader for the Technology Transfer Initiatives Program, will serve as our point of contact for liaison with your organization. He can be reached at (415) 422-6416.

We fully support your interest in enhancing the transfer of technology from the National Laboratories to the mining industry.

Sincerely,

John H. Nuckolls
Director

Copies to:
R. W. Kuckuck
G. T. Longerbeam
R. N. Shock



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



May 31, 1990

Dr. Francois Heuse
Head of Geomechanics Group
Lawrence Livermore National Laboratory
University of California
P.O. Box 808
Livermore, CA 94550

Dear Dr. Heuse:

As we discussed, it is unfortunate that I cannot visit Lawrence Livermore National Laboratory at this time. However, the Bureau of Mines is considering putting in place an ongoing effort to act as the "focal point" for Federal laboratory technology applicable to the mining and minerals industries. LLNL could definitely enhance such an effort. I will keep you informed of developments on this issue.

Sincerely yours,

Alan A. Campoli
Mining Engineer

cc: HKSacks
AACampoli
PRC Files

GMC:AACampoli:mm:5/31/9/90:(412)892-6558

Appendix I

Los Alamos National Laboratory (LANL)

APPENDIX I

Los Alamos National Laboratory
MME-Division, MS-D450
Los Alamos, NM 87545

Contact
Dr. Hugh Murphy
(505)667-8914

MISSION

Los Alamos National Laboratory's primary mission is the application of science and technology to problems of national security, including the maintenance of a strong defense, the fulfillment of arms control commitments, and the guarantee of a secure energy supply for the future. LANL also undertakes multi-disciplinary fundamental and applied research. Primary program areas: weapons, nuclear physics, nuclear materials production, magnetic fusion, and superconductivity. LANL has been designated one of three Superconductivity Pilot Centers to collaborate with industry in advanced high-temperature superconductivity technologies.

FINDINGS

My May 5, 1990 visit to LANL was hosted by Dr. Ed Van Eeckhout, Mining/Geological Engineer, Earth and Space Sciences Division. However, I met with over 15 individuals from a variety of divisions. The meetings were extremely well organized.

Mr. Ray A. Waller, Staff Assistant, Energy and Research Applications, provided me with an overview of LANL. The University of California manages LANL for the Department of Energy (DOE) with a staff of 7,800 employees, on an annual budget of approximately \$944 million. LANL spreads across more than 43 square miles of mesas and canyons in northern New Mexico. DOE/Defense funding accounts for 53 percent of FY91 funding, with DOE/Energy (22 percent), DOD convention weapons and SDI (22 percent), and work for others (3 percent) accounting for the remaining funding. PANAM support contractors, 2,000 employees, make up the remainder of LANL personnel.

Roy E. Jones, Industrial Applications Office, discussed LANL commitment to technology transfer. The mission of this office is to assure that the laboratory science and technology base is effectively used to produce significant industrial applications which enhance the security and economic posture of the nation. Laboratory management is solidly behind technology transfer, as is the case for all the multi-program national laboratories. The types of technology transfer efforts employed are: information sharing, consulting, personnel sharing, user facilities, collaborative research (cost shared), contract research (work for others), prototype development, entrepreneurial spin-offs, patent licensing, and consortia. Over 30 user facilities are made available to private and government user groups. I was given a well developed description of each facility. Almost all of the above mechanisms could be used by BOM personnel to access LANL technology, to perform our mission and benefit the mining and mineral industries.

C. Wes Myers, Division Leader, Earth and Environmental Sciences Division (EESD) gave me an overview of EESD activities. The division developed with the underground testing of nuclear weapons in Nevada. The tests are conducted 2,000 feet down, and require knowledge of the local geology, hydrology, and fault systems. The EESD capitalizes on other technology developed at LANL; in this respect, they are functioning as the "focal point" for earth and environmental sciences. Many EESD representatives gave specific presentations on EESD developments, later in the day. Wes summarized the strengths of the division as reservoir characterization and hazardous waste clean-up design.

Robert J. Harold, Project Leader, EESD, gave a presentation on a very successful oil recovery technology partnership between the DOE, U.S. oil industry, and LANL. This is a great example of how National Laboratory technology developed for defense research, can be brought to bear on industrial problems. A group of oil companies, majors and independents, contribute over \$1 million to the project, as compared to \$280K from the DOE, in return, they select from a number of research options presented to LANL. Thus, the industrial consortium guides the research. Cross-well tomography, developed for underground nuclear testing, is employed to map fracture propagation through advanced computer applications. This process dramatically improves water injection oil recovery from mature U.S. oil fields. A streamlined DOE approval process decentralizes project control and facilitates rapid decision making.

Donald W. Brown, Project Manager, EESD, discussed the hot dry rock (HDR) geothermal energy program he leads. Geothermal energy, in the form of naturally occurring high-temperature water, is presently providing electricity in a number of locations world wide. In these natural systems, an interconnected network of open fractures is present through which groundwater is circulated and heated. However, these systems require natural hydrothermal anomalies that are not abundant and of limited heat potential. The HDR program seeks to extract heat from 10,000 to 30,000 feet deep into the earth from artificially fractured reservoirs that emulate natural geothermal systems. An initial assessment of the U.S. HDR resource has been conducted. Multiple demonstrations have shown that wells can be directionally drilled and completed to depths of 5 km at temperatures above 300° C. Hydraulic pressurization to stimulate fracture networks has been tested at 3.6 km. Equipment for in situ geophysical measurements up to 300° C have been developed. The main technical task remaining involves the enlargement of the system to meet commercial power production. This is no trivial task. However, this is another example of how reservoir engineering developed for nuclear testing could impact the U.S. economy. In situ mining researchers from the Twin Cities Research Center have made arrangements to work with LANL HDR representatives.

Bruce Trent discussed LANL's considerable numerical modeling capabilities that are relevant to mining. Bruce provided me with a number of papers on various modeling procedures revolving around underground nuclear testing and subsidence resulting from underground openings. He sees application of numerical modeling for entry stability, water flow through fractures, tailings stability, blast technology, and rock bolt analysis. Of particular promise is porous flow through tailing dams (BOM environmental engineering) and surface mine blast design (BOM explosives research). The documentation Mr. Trent provided me should be passed on to the appropriate BOM researchers.

Carl A. Newton and C. L. Edwards presented ideas for BOM/LANL cooperation on geophysical instrumentation. The LANL geophysical capabilities were developed to monitor the results of underground nuclear testing. Fiber-optic strainmeters have been developed at LANL. They have been considering methods to get these units to the mining community. All present at the meeting displayed considerable excitement at the prospect of meshing the talents and strengths of the two organizations on use of fiber-optic strain meters for underground stress evaluation for ground control design and stress wave measurement for explosive testing. Immediate contact should be made through the appropriate BOM researchers.

Paul Aamodt and Don A. York, Health, Safety and Environment Division, presented LANL strategies for environmental restoration and clean-up. The approaches may be summarized as:

Excavation

- off site treatment
- disposal on site

Stabilization

- innovative capping
- chemical fixation

In situ treatment

- vapor extraction
- leaching with chemicals
- biological consumption

The in situ and heap leaching phases of soils treatment program could benefit from consultation with the Spokane Research Center's experts in this area. The papers they provided should be sent to SRC.

David R. Janecky, Staff Geochemist, discussed LANL chemical processes involving fluids in rocks. David has discussed cooperative geochemical research on an informal level with Twin Cities Research Center's Steve Paulson and Lloyd Petry. Many such relationships at DOE Laboratories were found, people who want to work with BOM personnel but did not know if their respective managements would support such efforts. An impressive set of applied computational geochemistry techniques are employed at LANL. Of particular interest was the development of stable isotopically labeled organic tracers for geological processes. This technique can follow complex effluent flows, indicate bioflows, and monitor the health of environment for organisms. This could be of great value to BOM environment engineers.

Paul Johnson, Staff Geophysicist, discussed the doublet method for evaluation of cross-well tomography and underground microseismic analysis. The doublet method evaluates the entire energy wave, encompassing its entire coda. He feels this could have dramatic effects on the BOM micro seismic program.

Dr. Brian Brady, Denver Research Center, should call Paul (505) 667-8936 or FTS 843-8936 to investigate this situation.

Robert J. Harold, Project Leader, Earth and Space Sciences Division, discussed thermal spallation drilling. This flame jet cutting technique takes advantage of the thermal characteristics of rock to cut a borehole without abrasion tools. A flame heats the surface of the rock causing it to crack and spall. The exhaust gasses carry the chips to the mouth of the borehole. This technique could be used to selectively mine ore pockets, as if the flame is left in place a cavity results. This could be a useful technique for precious

metal mining or deep recovery of gas. New Mexico Tech is working on the latter.

RECOMMENDATIONS

The LANL is another example of a multi-program laboratory with a wealth of existing devices and processes that could benefit the mining and minerals industry. My visit just touched on a portion of these issues. Much time and effort could be productively expended on bringing these developments into the applied BOM research programs for demonstration to the mining and mineral industries.

It is recommended that expert-to-expert contacts be immediately developed between the BOM and LANL in the following areas: fiber-optic strain meter technology - Ground and Methane Control and Explosive Group, PRC; and isotopically labeled organic tracers - Environmental Staff Engineer, WO.

John Murphy - PR



Los Alamos National Laboratory
of the University of California

Los Alamos, New Mexico 87545

January 16, 1990

DM
Mr. David R. Forshey
Associate Director--Research
US Department of the Interior
Bureau of Mines
2401 E Street, NW
Washington, DC 20241

Dear Mr. Forshey:

Thank you for your December 19, 1989, letter regarding technology transfer from the National Laboratories to the minerals industry and using the Bureau of Mines as the liaison for this activity.

Los Alamos will be pleased to contribute to this effort. I am designating one of my staff as our principal point of contact:

Dr. Hugh D. Murphy
MEE-Division, MS-D450
Los Alamos National Laboratory
Los Alamos, NM 87545

Phone: 505-667-8725
FTS 843-8725

Dr. Murphy, a former program manager for our hot-dry-rock geothermal program, will be happy to work with Mr. Alan Campoli in developing the six-month investigation to better define the role of the Bureau of Mines in this area. Furthermore, Dr. Murphy will be able to suggest other appropriate initiatives based on his knowledge of Los Alamos capabilities of potential interest to the minerals industry.

Sincerely,

S. S. Hecker

S. S. Hecker
Director

cc: A. A. Campoli, Pittsburgh, PA



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



May 21, 1990

Dr. Hugh D. Murphy
MME-Division, MS-D450
Los Alamos National Laboratory
Los Alamos, NM 87545

Dear Dr. Murphy:

My May 5, 1990 visit to Los Alamos National laboratory was very informative and well organized. This was due to the fine efforts of Dr. Ed Van Eeckhout, Mining/ Geological Engineer, Earth and Space Sciences Division and many other LANL personnel. The possibility of cooperative Bureau of Mines and LANL research in the areas of fiber-optic strain meter technology and isotopically labeled organic tracer technology should be explored immediately.

Sincerely,

Alan A. Campoli
Mining Engineer

cc: AACampoli
HKSacks
EVanEeckhout

GMC:AACampoli:jed:5/21/90:412-892-6558

Appendix J

Oak Ridge National Laboratory (ORNL)

APPENDIX J

Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 87545

Contact
Dr. William Fulkerson
Associate Director, Advanced Energy Systems
FTS 624-5510

MISSION

Oak Ridge National Laboratory (ORNL) primarily supports the fission nuclear fuel cycle and development of magnetic fusion energy through scientific research and technology. In addition, ORNL identifies and solves generic research problems in energy technologies such as materials, separation techniques, chemical processes, and biotechnology and is the major national source of stable and radioactive isotopes. Primary program areas are: basic energy sciences, fusion energy, fission energy development, conservation and renewable energy, defense programs, biomedical and environmental sciences.

FINDINGS

ORNL is operated by Martin Marietta Energy Systems, Inc. with a staff of 5,500 individuals for the DOE, on an annual budget of approximately \$450 million. ORNL is composed of six Associate Directorates: Operations; Chemical, Environmental, and Health Protection Technologies; Nuclear Technologies; Advanced Energy Systems; Biomedical and Environmental Sciences; and Physical Sciences and Advanced Materials.

My April 6, 1990, visit to ORNL was hosted by Dr. William Fulkerson of the Advanced Energy Systems Directorate and his staff. However, I met with over 20 individuals, who represented the other directorates. The meetings were extremely well organized.

Rod Judkins, Manager, Fossil Energy Programs briefed me on the recent developments in this area. He gave a presentation at the March 20, 1989, Pittsburgh meeting. The Fossil Energy Program is spread over all the multiprogram laboratories. ORNL work includes: bioprocessing of coal; coal liquids characterization and upgrading; effects of acid rain and carbon dioxide; coal geology; fluidized-bed combustion; ceramic hot-gas cleanup filters; clean coal technologies; and fossil fuel supply models. As was the case at Ames, Argonne, Brookhaven, PETC, and METC, ORNL communicates well with the mining and minerals industry in this program area.

Joe Dooley, Program Development Manager, Applied Technology Division, discussed the many technologies ORNL is trying to transfer to industry. Of particular interest were: the fiber-optic stress meter; fiber-optic high power transmission for blast detonation; laser based sensing; comparative photo imaging for structural analysis (in-mine convergence?); electric motor failure prediction; intense microwave sources for ore processing; and plasma/ore processes for ore processing. The fiber-optic stress meter should be immediately investigated by GMC personnel. A BOM representative could spend weeks studying and placing these developments within our research

program. This is a fine example of the fertile ground available within the multiprogram laboratories.

Reinhold Mann, Robotics and Intelligent Systems, provided a demonstration of advanced learning robots. He feels that he and his people could be of great help to our robotics people, in the area of intelligent sensor systems for coal/rock interface detection.

Bill Knee, Group Leader, Cognitive Systems and Human Factors, was very interested in BOM Human Factors research. ORNL used BOM results as base data for accident analysis. Bill would like to talk to the WO staff engineer for this area.

Jim Weir, Advanced Materials Directorate spoke on technology transfer to the mineral industry. He has recently worked with the National Coal Association, Albany Research Center, and the Tuscaloosa Research Center. It turns out the advanced materials developed at ORNL have found many uses in coal burning equipment and ore processing. ORNL is the lead DOE facility for ceramic research, and is well aware of BOM research.

Jon E. Soderstrom, Director of Technology Licensing, is the exact type of individual a BOM technology transfer "pull person" would look for. His job is to match ORNL developments with end users in the commercial sector. The most difficult aspect of his job is getting ORNL to do the applied research necessary to demonstrate the usefulness of the developments. The BOM is to large extent in the applied research business, and could fit into this equation very nicely. Jon feels that the BOM "pull person" approach would be well received by the DOE laboratory system.

Camden Hubbard provided a tour of the new \$19 million ORNL, High Temperature Materials Laboratory. It is a user facility providing research equipment needed to characterize the microstructure and microchemistry of materials and to investigate the effect of these parameters on the properties of materials. The Albany Research Center (George Laird) recently completed a study of multi-phase materials in this lab. The Sullivan Mining Corporation (Tom Sullivan), San Diego, CA also has recently used this facility.

Alan Witten gave a presentation on Geophysical Diffraction Tomography. ORNL researchers in this area are aware of BOM cross-borehole tomography research and they communicate regularly. Alan's work is unique because he uses a numerical processing system to enhance the accuracy of anomaly location. His system is employed in tunnel finding missions at the DMZ in Korea and in dinosaur bone excavation. Sandia also has a program in this area.

Randy Curlee and Don Lee gave presentations on Solid Waste Recycling and Disposal. A BOM funded project to assess information needs for advanced materials is ongoing at ORNL. An interdisciplinary effort in mine and mill tailing remediation is planned. The remainder of the discussion centered on nuclear waste ceramic encasement and recycling of plastics. ORNL environmental analysis of leaky aquifers for in situ mining and waste disposal involves the Twin Cities Research Center.

Charles D. Scott gave a very impressive presentation on Bioprocessing Research at ORNL. Typical applied biological research at ORNL includes: photo chemistry for hydrogen productions; cellulose solubilization of cellulose;

biological solubilization of coal; biological removal of heavy metals and microbial screening for PCB degradation. Dr. Scott is a very impressive individual and is more than willing to discuss sharing his developments with BOM researchers. A representative from the PRC Environmental Technology Group should contact him.

Jim Wilson gave a presentation on Soil Venting and Air Stripping. The process involves the separation of petrochemicals from ground water. ORNL has need of direction drilling expertise, the Ground and Methane Control Group gained such expertise during the Corp of Engineer's sponsored earthen dam dewatering project. Mr. Wilson should be contacted by GMC.

RECOMMENDATIONS

The ORNL is another example of a multiprogram laboratory with a wealth of existing devices and processes that could benefit the mining and minerals industry. My visit just touched on a portion of these issues. Much time and effort could be productively expended on bringing these developments into the applied BOM research programs, for demonstration to the mining and mineral industries.

It is recommended that expert-to-expert contacts be immediately developed between the BOM and ORNL in the following areas: fiber-optic stress meter technology - GMC, PRC; human factors - WO staff engineer; bioprocessing and bioengineering - ET, PRC; soil venting and air stripping - GMC, PRC; and intelligent sensor systems.



United States Department of the Interior

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PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



April 26, 1990

Dr. William Fulkerson
Associate Director, Advanced Energy Systems
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 87545

Dear Dr. Fulkerson:

Thank you for hosting my April 6, 1990, visit to the Oak Ridge National Laboratory. My visit was very informative due to the many ORNL personnel who were so generous with their time and expertise. The organizational efforts of Robin A. Cantor, Rod Judkins, and your staff made the meetings exceptionally fruitful.

The possibility of immediate Bureau of Mines to ORNL contact in the areas of fiber-optic stress meter technology, human factors, bioprocessing and bioengineering, soil venting and air stripping, and intelligent sensor systems should be explored. These contacts should be initiated after Dr. Ken Sacks, Deputy Research Director, Pittsburgh Research Center, has set up the interaction through you.

Thank you,

Alan A. Campoli
Mining Engineer

cc: HKSacks
AACampoli
RACantor

GMC:AACampoli:jmt:4/26/90:892-6558

Appendix K

Battelle Pacific Northwest Laboratories (PNL)

APPENDIX K

Battelle Pacific Northwest Laboratory
Battelle Boulevard
P.O. Box 999
Richland, WA 99352

Contact
Mr. L. Donald Williams
Director of Technology Transfer
(509)375-2231

MISSION

Battelle Pacific Northwest Laboratory (BPNL) develops and deploys technology for energy security and national defense and transfers technology to enhance the international competitiveness of the United States. As the research and development laboratory for the Hanford Site, BPNL provides advanced technology and environmental surveillance to support Hanford operations. Primary program areas: commercial and defense radioactive and hazardous waste, biological and environmental research, nuclear energy, conservation, renewable energy and materials.

FINDINGS

In 1965, Battelle Memorial Institute assumed management of the DOE Hanford Laboratories which were renamed to the Battelle Pacific Northwest Laboratory (BPNL). More than a government research facility, under terms of the DOE contract, BPNL would seek research and development programs sponsored by other government agencies and industry to expand the area's technology base and strengthen the local economy.

BPNL is a DOE multi-program laboratory, performing research and development in nearly every aspect of energy technology and related basic science. FY91 funding and staffing are \$300 million and 3,5000, respectively.

Marvin Clement, Manager, Office of Research and Technology Applications, hosted my April 18, 1990, visit to BPNL. Marvin was very knowledgeable in the work done by Battelle. In FY91, over 350 projects funded with \$20 million from over 20 industry and government organizations, will be performed. Between 1974 and 1984, 11 BOM contracts were completed, for this, the BOM paid BPNL over \$4 million. Three projects accounted for \$3 million, they were: investigation of extending surface mine wire rope life, development of conveyor-type cross-pit overburden and materials handling system, and development of a large diameter coal mine shaft drilling system. Due to this past BOM contribution to BPNL funding, many personnel called my attention to "half finished" work they would love to continue at BOM expense. I went out of my way to convince those individuals that those days are long gone.

BPNL is organized along technology lines with nine major groups: Applied Physics; Earth and Environment Sciences; Life Sciences; Materials and Chemical Sciences; Public Policy and Planning; Molecular Sciences; Reactor Technology; Waste Technology; and a catch all group called Laboratory Programs. Laboratory

Programs includes the Yucca Mountain Support Group, Japan Waste Management Office, Industrial Modernization Office, and anything else that does not fit in the other eight main laboratory groups. So many programs and ideas are worked on by more than one multiple program laboratory. This is the third multi-program laboratory to talk about in situ vitrification of nuclear waste. If I didn't know better, I would have come to the conclusion that BPNL developed the idea alone.

I met with Don Williams, our designated contact and my host Marvin Clement's boss. He was extremely supportive of our plan to institute a "pull" component to BOM Technology Transfer, and highly complementary of our efforts and accumulated knowledge on the DOE and how it functions. He recommended that I see BOM and DOE WO Technology Transfer managers prior to release of the final report.

Don E. Rasmussen, Applied Mechanics and Structures, gave me a tour of BPNL materials testing section. A triaxial load frame which determines the effect of hydrostatic pressure on rock core fracture propagation could have an influence on methane control systems design. An image analysis system is used for post load evaluation of hydro pressure effects.

As was the case with the other multi-program laboratories, they have mini BOMs for Geosciences and Environmental groups. W. H. Walters, Surface Water Group, is conducting a project to rehabilitate mine tailing piles at the Holden Mine Site, Lucerne, Washington. The project is funded by the U.S. Forest Service to reduce contaminant release, reestablish fisheries, and foster recreation. Walter was very interested in speaking to Bob Kleinmann about the BOM bog treatment for acid mine water.

RECOMMENDATIONS

BPNL and the other multi-program DOE National Laboratories, should be the subject of an ongoing BOM search for technology applicable to the mining and mineral industries.

Methane control systems designers, within GMC/PRC should be informed of Mr. Rasmussen and the BPNL triaxial hydrostatic core test procedure. An Environmental Technology representative should contact Mr. Walters, relative to acid mine drainage treatment techniques developed by the BOM. Perhaps he could be invited to a water treatment seminar or for a visit to PRC.

John Keiser - PNL



Battelle

Pacific Northwest Laboratories
Battelle Boulevard
P.O. Box 999
Richland, Washington 99352
Telephone (509) 375-2201

January 15, 1990

Mr. David R. Forshey ^{DR}
Associate Director--Research, WO
US Department of the Interior
Bureau of Mines
2401 E. Street, NW
Washington, DC 20241

Dear Mr. Forshey:

The Pacific Northwest Laboratory (PNL) as well as the other national labs have a wealth of expertise and research and development programs that could benefit the US Department of the Interior and the minerals industry.

Your long term strategy and decision to develop a technical relationship between the national labs and the mining industry should serve to enhance current and future mining research. The selection of the Bureau of Mines as a focal point for liaison between the national labs and the mineral industry could complement some of the current activities being conducted. We at PNL have worked with the Bureau of Mines and the mining industry for some time and consider this new emphasis an important complement to these activities.

For your information, the American Society of Mechanical Engineers has a subcommittee of representatives of the national labs called the National Laboratory Technology Transfer Committee. One of the areas of focus of this committee is working with the mining industry to effect a better technology transfer program in association with the mining industry. Coordination with this committee may also be a benefit to the Bureau of Mines in the conduct of their six month investigation. The task leader for the mining program is Dr. Dennis Keiser of the Idaho National Energy Laboratory (208-526-1770).

PNL would be pleased to work with the representative from the Bureau of Mines during this study. The contact point for our organization will be L. Donald Williams, Director of Technology Transfer (509-375-2231).

Sincerely,


W. R. Wiley
Director

cc: D Keiser
LD Williams



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



April 26, 1990

Mr. L. Donald Williams
Director of Technology Transfer
Battelle Pacific Northwest Laboratory
P.O. Box 999
Richland, WA 99352

Dear Mr. Williams:

Many thanks to you and your staff for organizing my April 18, 1990, visit to the Battelle Pacific Northwest Laboratory (BPNL). Mr. Marvin Clement was a very knowledgeable and enjoyable host. Mr. Clement's dedication and commitment to BPNL was very impressive.

Your counsel and advice relative to how the Bureau of Mines can help engender a closer relationship between the DOE laboratory system and the mining and mineral industries was greatly appreciated.

Dr. Ken Sacks, Deputy Research Director, Pittsburgh Research Center, will call Mr. Clement to discuss the possibility of immediate BOM to BPNL expert-to-expert contact in the areas of mine tailing remediation, and triaxial hydrostatic core testing.

Sincerely,

Alan A. Campoli
Mining Engineer

Appendix L

Sandia National Laboratory (SNL)

APPENDIX L

Sandia National Laboratory
P.O. Box 5800
Albuquerque, NM 87185

Contact
Mr. Virgil Dugan
Director of Advanced Technology
(505) 844-8735

MISSION

The principal mission of Sandia National Laboratory (SNL) is research, development and engineering of nuclear weapon systems, except for the nuclear explosive. The result of this effort is the existence of a national stockpile of operational nuclear weapons that are safe, secure, reliable, and strictly controlled. SNL also conducts energy programs in fossil, solar, fission, and basic energy sciences. Primary program areas are: weapons, commercial and defense radioactive waste, solar energy, verification, and control.

FINDINGS

SNL is operated by AT&T Technologies, Inc. for the DOE. Annual funding is approximately \$1,100 million for SNL, supporting a staff of approximately 8,400.

SNL was not visited. However, Mr. Dugan expressed interest in an ongoing BOM effort, if one is established.

RECOMMENDATIONS

SNL is a multiprogram DOE National Laboratory, as such it represents a significant source of technology for the mining and mineral industries. It should be the subject of an ongoing BOM "focal point" effort.



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



May 31, 1990

Mr. Virgil Dugan
Director of Advanced Energy Technology
Sandia National Laboratory
P.O. Box 5800
Albuquerque, NM 87185

Dear Mr. Dugan:

As we discussed, it is unfortunate that I cannot visit Sandia National Laboratory at this time. However, the Bureau of Mines is considering putting in place an ongoing effort to act as the "focal point" for Federal Laboratory technology applicable to the mining and mineral industries. Sandia could definitely enhance such an effort. I will keep you informed of developments on this issue.

Sincerely yours,

Alan A. Campoli
Mining Engineer

cc: HKSacks
AACampoli
PRC Files

GMC:AACampoli:mm:5/31/90:(412)892-6558

Appendix M

Ames Laboratory

APPENDIX M

Ames Laboratory
Iowa State University
119 O & L Building
Ames, IA 50011

Contact
Dr. Richard Markuszewski
Director Fossil Energy Program
(515) 294-1856

MISSION

The Ames Laboratory conducts research in the physical, chemical, materials, mathematical, and engineering sciences which underlie energy-generation, -conversion, and -transmission as well as other technical areas essential to national interests. This effort is maintained so as to contribute to the achievement of DOE goals and to contribute to the achievement of knowledge and technical capabilities. Fundamental work is conducted to support energy technologies foreseen in the intermediate to long-range future, novel solutions to problems associated with these technologies is pursued, and energy-related applied research is carried out through the proof of technical soundness. Ames relies upon its strengths in materials synthesis and processing, materials reliability, chemical analysis, chemical sciences, materials sciences, and applied mathematical sciences to conduct the basic research needed to solve the complex problems encountered in energy production and utilization.

FINDINGS

Dr. Richard Markuszewski was the host for my March 20, 1990 visit to the Ames Laboratory. He provided an overview of Ames and the Fossil Energy Program. Ames is operated by Iowa State University under a \$25 million a year DOE contract. However, a thin line exists between DOE, university, and BOM funded Mineral Research Institute research. Many Ames personnel have responsibilities that cover all three funding sources. Richard is also the director of the Iowa State Mining and Mineral Resources Research Institute (ISMMRRI). ISMMRRI has been in existence since 1979, supported with BOM funds.

The Fossil Energy Program conducts coal preparation research for the Pittsburgh Energy Technology Center (PETC) and coal waste disposal research for the Morgantown Energy Technology Center (METC). PETC funded coal preparation research is highlighted by chemical cleaning processes, ultrasonic enhanced gravity separation techniques, automated image analysis of mineral matter in coal, and molybdenum beam scan for sulfur content. METC work centers on neutralizing the acidity of coal waste prior to disposal.

William Buttermore, Assistant Director, ISMMRRI, discussed the ultrasonic coal preparation technique. The ultrasonic waves enhance gravity separation by cleaning the surface of the fine coal particles, while they are in the froth flotation system. He wishes to talk to the Tuscaloosa Research Center expert on ultrasonic copper and phosphate ore flotation kinetics project.

Iowa produced 17 million tpy of coal at the turn of the century for railroad usage. Only 1 million tpy of coal is produced today. The coal is very high sulfur and not of good btu value. The state of Iowa funded a surface coal mine and preparation plant at Ames, to demonstrate the successful cleaning of Iowa coals. The mine and preparation plant were closed in 1986. I was provided with a tour of the preparation plant.

The Fossil Energy Program communicates with the coal industry through many technical organizations. I was given a 22-page list of publications and presentations done since 1985. Dr. Markuszewski, who attended the March 20, 1989, Senator Domenici meeting held in Pittsburgh, said that Ames was noted as an exception to the poor response of the DOE Laboratories to the mining and mineral industries. Ames has participated in all of the recent DOE and BOM sponsored coal preparation conferences.

Frederick A. Schmidt, Director, Materials Preparation Center (MPC), provided me with an overview of MPC and related research. Ames has unique capabilities for the preparation, purification, fabrication, and characterization of metals, ceramics, and other materials developed over 40 years of DOE energy and weapons research. Ames will supply materials to industry that can be obtained no where else. An information service is also available to assist industry, academic, and government researchers locate commercial sources of hard to find materials. Dr. Schmidt sponsors industry seminars to identify new applications of special materials. He would like to put together such a seminar on mining cutting tools. BOM researchers working on cutting tools improvement should contact him.

Richard F. Gaertner, Director, Center for Advanced Technology Development (CATD), described Iowa State University's unique approach to development of technology for commercial purposes. CATD was started with \$20 million from the U.S. Departments of Commerce and Energy. It seeks to facilitate the commercialization of selected Iowa State University and Ames Laboratory technical advances, to improve the state of Iowa's economy. The approach involves doing the applied research and financial planning necessary to reduce the risk of launching new companies, based on ISU and Ames developments. A company is being organized to sell optical fiber chemical sensors and monitoring devices. Such a system could be of use to the Environmental Technology Group, PRC, in the remote sensing of water quality, ET personnel should contact Dr. Gaertner.

Daniel E. Williams, Associate Director, Planning and Technology Applications, gave me an overview of technology transfer at the Ames Laboratory. He was very knowledgeable in the DOE technology transfer efforts and the Federal Laboratory Consortium (FLC). We discussed providing the Washington technology transfer office with additional personnel to pull in research developments that would be the basis of new BOM projects or directly transferred to the mining and mineral industries. He agreed that this approach would be far superior to creating a separate function and pointed out that the formation of new entities would confuse outside organizations, hindering effective communication. It was suggested the FCC clearing house be employed in our efforts and that government laboratories outside the DOE be approached in a continuation of this work.

Dr. Williams said Senator Byrd's \$26 million National Technology Transfer Center will be funded with NASA funds. Current NASA employees Len Ault (202) 453-8377 and Robert M. Barlow (601) 688-1929 will organize the Wheeling, WV facility.

Karl Gschneidner, Director, Rare-earth Information Center (RIC), gave me a presentation on activities at the RIC. The RIC serves the scientific and technological communities by collecting, storing, evaluating, and disseminating rare earth materials information. The Salt Lake City Research Center is a sponsor of the RIC News, and should be used as a contact point.

Delwyn D. Bluhm discussed discontinued microwave coal preparation experiments. The Twin Cities and Reno Research Centers have been in contact with him over the years. Illustrating the effectiveness of Ames past cooperation with the BOM.

RECOMMENDATIONS

The effectiveness of the Fossil Energy Program at Ames in communicating developments to the coal preparation industry is quite good. Dr. Markuszewski is well known in the industry. The BOM should not interfere in these well developed relationships.

It is recommended that BOM researchers be made aware of Dr. Frederick Schmidt and the Ames Materials Preparation Center. The MPC can provide a valuable service to BOM materials science researchers. The Washington Office staff engineer for materials science should visit Dr. Schmidt and the MPC. The Tuscaloosa Research Center expert on ultra sonic copper and phosphate ore flotation kinetics project should contact William Buttermore. The Environmental Technology Group, PRC should contact Dr. Gaertner relative to optical fiber chemical sensors and monitoring devices.

These contacts should be made after Dr. Ken Sacks, Deputy Research Director, Pittsburgh Research Center has set up the interaction with Dr. Markuszewski.

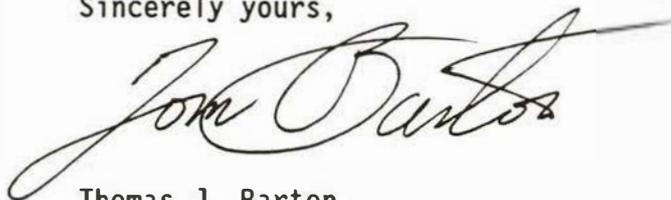
January 30, 1990

Mr. David R. Forshey
Associate Director--Research, WO
United States Department of Interior
Bureau of Mines
2401 E Street, N.W.
Washington, D.C. 20241

Dear Mr. Forshey: *DF*

Thank you for your informative letter of December 19, 1989. I have asked Dr. Richard Markuszewski to act as our contact point with your office. Dr. Markuszewski is the Ames Laboratory Program Director for Fossil Energy.

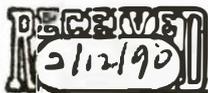
Sincerely yours,



Thomas J. Barton
Director, Ames Laboratory
Distinguished Professor of Chemistry

TJB:kh

cc: Dr. Richard Markuszewski





United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



March 23, 1990

Dr. Richard Markuszewski
Ames Laboratory
U. S. Department of Energy
Iowa State University
119 O & L Building
Ames, IA 50011

Dear Dr. Markuszewski:

Thank you for hosting my March 20, 1990, visit to Ames Laboratory. The effectiveness of the Fossil Energy Program at Ames in communicating developments to the coal preparation industry is quite good. I am convinced you are instrumental in the success of this program. My visit was very informative due to the many Ames personnel who were so generous with their time and expertise.

The Bureau of Mines (BOM) materials researched should be made aware of the Ames Material Preparation Center and the fine efforts of Dr. Fredrick Schmidt. Also, BOM and Ames ultrasonic beneficiation experts should compare developments. These contacts will take place after Dr. Ken Sacks has setup the interaction through you.

Thank you,

Alan A. Campoli
Mining Engineer

Appendix N

Energy Technology Engineering Center (ETEC)

APPENDIX N

Energy Technology Engineering Center
P.O. Box 1449
Canoga Park, CA 91304

Contact

Mr. Guy Ervin, III
(818)700-5532

MISSION

The Energy Technology Engineering Center (ETEC) test components being developed for the U.S. liquid-metal reactor program. ETEC maintains and operates liquid-metal test facilities for evaluating components such as heat exchangers, steam generators, pumps, valves, piping, vessels, and instrumentation. Primary program areas: nuclear energy, conservation, and renewable energy.

FINDINGS

ETEC is operated by Rockwell International Corporation for the DOE. Annual funding and staffing level are approximately \$26 million and 160.

The ETEC was not visited. However, Mr. Ervin expressed interest in an ongoing BOM effort, if one is established.

RECOMMENDATIONS

The ETEC should not be ignored in an ongoing BOM "focal point" effort.

John Murphy - 1/21

Energy Technology Engineering Center
Rocketdyne Division
Rockwell International Corporation
P.O. Box 1449
Canoga Park, California 91304



Rockwell
International

Operated for U.S. Department
of Energy

February 13, 1990

In reply refer to 90ETEC-DRF-0298

Mr. David R. Forshey ^{DRF}
Associate Director, Research
Bureau of Mines
U. S. Department of the Interior
2401 E Street, N. W.
Washington, DC 20241

Dear Sir:

The following information is provided in response to your
December 19, 1989 letter regarding liaison between the Bureau of Mines
and the National Laboratories:

Designated Contact Point for the Energy Technology Engineering Center:

Mr. Guy Ervin, III
ETEC MS-T038
P. O. Box 1449
Canoga Park, CA 91304
(818) 700-5532
FAX (818) 700-5118

Upon request Mr. Ervin will be happy to provide information about ETEC
technical activities, and he will interface with you or your designee on
technology transfer matters.

Very truly yours,

D. C. Gibbs
Vice President and General Manager (A)
Energy Technology Engineering Center

27j-23



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
DOCHRAN'S MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



May 31, 1990

Mr. Guy Ervin, III
Energy Technology Engineering Center
MS T038
P.O. Box 1449
Canoga Park, CA 91304

Dear Mr. Ervin:

As we discussed, it is unfortunate that I cannot visit the Energy Technology Engineering Center at this time. However, the Bureau of Mines is considering putting in place an ongoing effort to act as the "focal point" for Federal laboratory technology applicable to the mining and mineral industries. ETEC could enhance such an effort. I will keep you informed of developments on this issue.

Sincerely,


Alan A. Campoli
Mining Engineer

cc: AACampoli
HKSacks
PRC Files

GMC:AACampoli:jed:5/31/90:(412)892-6558

Appendix O

Fermi National Accelerator Laboratory

APPENDIX O

Fermi National Accelerator Laboratory
Box 500
Batavia, IL 60510

Contact

Dr. Richard A. Carrigan, Jr.
Office of Research and Technology Applications
(312) 840-3333

MISSION

Fermi National Accelerator Laboratory explores elementary particle physics to broaden the understanding of the basic structure of matter. Improvement of accelerator designs has resulted in numerous technical spin-offs: the development of superconductivity on an industrial scale, fast electronics and particle detector technology, and special computers and computer programs. Fermilab's linear accelerator is used in cancer therapy, and the laboratory has become heavily involved in medical radiation therapy. Primary program area: high energy physics.

FINDINGS

Dr. Richard A. Carrigan, Jr. and John T. Venard of the Office of Research and Technology Applications provided me with insight into technology transfer at Fermilab and a tour of the facility, on March 23, 1990. Fermilab is operated by University Research Association (UAI) under a \$151 million a year DOE contract. UAI is made up of 77 universities, the majority of which are located in the U.S.

The research done at Fermilab is to explore the basic structure of matter with the Tevatron accelerator. The Tevatron is a synchrotron capable of accelerating protons to one trillion electron volts. It also has the capability to circulate antiprotons in the opposite direction in the same vacuum chamber as the protons: the two beams collide at six places on the 4 mile circumference ring. When collisions occur between the two particle beams, the center-of-mass energy of the collisions is the sum of the energy of the two colliding beams. The higher the energy of collision, the more detail that will emerge. Thus, the collider mode is a tool for exploring the spectrum of particle interaction. The challenge is to find ways to observe the proton-antiproton collisions and interpret the interactions. Devices built for this purpose are called detectors. At present Fermilab researchers are searching for the sixth quark (particles that make up the proton). They predict that the grand unification theory for the origin of the universe will be proven in this way.

RECOMMENDATIONS

Other than support facilities for the Tevatron, Fermilab conducts only particle physics education programs and neutron cancer treatment research. Thus, they have little to no interest in the mining and mineral industries. Fermilab should not be included in any future actions.

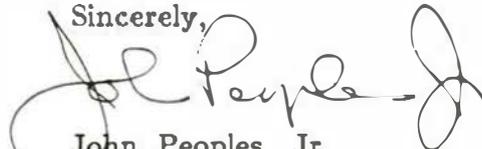
January 10, 1990

Mr. David R. Forshey ^{OK}
Associate Director--Research, WO
United States Department of the Interior
Bureau of Mines
2401 E Street, N.W.
Washington, DC 20241

Dear Mr. Forshey:

Thank you for your letter of December 19, 1989 informing us of the upcoming study of National Laboratory research related to the mineral industry. Your contact at Fermilab should be Dr. Richard A. Carrigan, Jr., Head of the Office of Research and Technology Applications. I hasten to add that we have little contact with the mineral field. Our principal "mining" interest is seeing that a viable supply of helium remains available.

Sincerely,



John Peoples, Jr.
Director

JP-RC:po



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



March 29, 1990

Dr. Richard A. Carrigan, Jr.
Office of Research and Technology Applications
Fermi National Accelerator Laboratory
MS-208
Box 500
Batavia, IL 60510

Dear Dr. Carrigan:

I appreciate the time and effort you and John T. Venard put into my March 23, 1990, visit to the Fermi National Accelerator Laboratory. Fermilab is quite an impressive facility. But, as Dr. Peoples stated in his letter of January 10, 1990, the exploration of elementary particle physics has little impact on the mining and mineral industries. However, your insight on how the Bureau of Mines can assist the mining and mineral industries in accessing National Laboratory developments was of considerable value.

Thank you,

Alan A. Campoli
Mining Engineer

Appendix P

Morgantown Energy Technology Center (METC)

APPENDIX P

Morgantown Energy Technology Center
P.O. Box 880
Morgantown, WV 26507

Contact
Ms. Carol Roberson
FTS 923-4308

MISSION

The Morgantown Energy Technology Center (METC) conducts research and development to expand the technology base for fossil energy production, conversion, and utilization. METC is the lead center for 13 fossil energy programs. In addition to the facility at Morgantown, West Virginia, METC's research and development program is executed through contacts with industry and academia. Primary program areas: coal gasification, fluidized-bed combustion, heat engines, gas stream cleanup, fuel cells, unconventional gas recovery, oil shale, and tar sands.

FINDINGS

Dr. Harvey Ness, Associate Director for Applied Science and Technology, provided a tour, on March 5, 1990, of selected portions of the facility and discussed the possibility of future METC action on this issue. METC through cost sharing contracts encourages the private sector to deploy new fossil energy technology. This process brings METC in close contact with the fossil fuel industry and the Bureau. An example of this is the Water jet Assisted Mining project Ed Thimons, Dust Control and Ventilation, PRC is involved in.

RECOMMENDATIONS

Due to an already close relationship between METC and the fossil fuel industry, no future action is warranted.



Department of Energy
Morgantown Energy Technology Center
P.O. Box 880
Collins Ferry Road
Morgantown, West Virginia 26505

January 10, 1990

DOE 1/16

Mr. David R. Forshey
U.S. Department of the Interior
Bureau of Mines
2401 E Street, NW
Washington, D.C. 20241

Dear Mr. Forshey:

Thank you for your letter of December 19, 1989, describing the formal position taken by Interior relative to the role of the National Laboratories in the minerals industry. I fully agree with the positions taken by T. S. Ary and Secretary Lujan. As an aside, this Laboratory (the Morgantown Energy Technology Center) is a Federal Laboratory not unlike your Pittsburgh Research Center, and thus has the same liaison role with the energy industry that you share with the minerals industry. Consequently, we will not be part of your upcoming activity, but we will certainly be pleased to offer any assistance that you may require. I think the model being pursued is proper and one that should be adapted universally by all Departments that have a direct linkage to the private sector in non-defense endeavors.

Sincerely,

A handwritten signature in cursive script, appearing to read "A. A. Pitrolo".

A. A. Pitrolo
Director, METC

:v\h

cc:
M. R. McElwrath, DOE
B. Sweeny, DOE



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



March 12, 1990

Ms. Carol Roberson
Morgantown Energy Technology Center
P.O. Box 880
Morgantown, WV 26507

Dear Ms. Roberson:

Thank you for making time in your busy schedule to meet with me on March 5, 1990. Dr. Harvey Ness, Deputy Director for Applied Science and Technology, provided me with an excellent description of the Morgantown Energy Technology Center's Fossil Energy Research and Development program. His patience was greatly appreciated. Please add me to your technology transfer mailing list.

Sincerely,

Alan A. Campoli
Mining Engineer

cc: Dr. Harvey Ness

H.K. Sacks
A.A. Campoli
P.H.C. Foster

Appendix Q

EG&G Mound Applied Technologies

APPENDIX Q

EG&G Mound Applied Technologies
P.O. Box 3000
Miamisburg, Ohio 45343

Contact
Dr. Japnell D. Braun
Manager of Technology Transfer
(513) 865-3829

MISSION

Mound is an integrated research, development, and production facility performing work in support of DOE's weapon and energy-related programs, with special emphasis on explosives, nuclear, and energy technology. Primary program areas: weapons, special nuclear projects, basic energy sciences, safeguards and security, health and environmental research, nuclear materials production, defense waste and by-products, and waste disposal and remedial action.

FINDINGS

EG&G Mound Applied Technologies operates the Mound facility under contract for the DOE. After a March 7, 1990, morning meeting and lunch with the energetic and impressive Dr. Braun, I was provided a tour of the materials analysis and ceramics facilities. Mound has well developed scanning electron microscope and strength of materials testing capabilities that could be used by BOM personnel.

The day ended with a round table discussion attended by 20 EG&G managers and technical personnel. The discussion opened my eyes to the willingness of EG&G to help us in our mission. They feel they have much to offer the mining and minerals industry in the areas of energetic materials, ceramics, thermite welding and burning, metallurgy, and ultrasonic non-destructive testing.

Mr. Richard DeSando, a manager in the energetic materials area, was very impressed with past BOM explosive safety work done under contract for the DOD, he associated with Ken Cashdollar, Fires and Explosions Group. He wants to discuss the possibility of further DOE funded BOM explosives safety testing.

Another EG&G representative suggested that laser initiated firing of surface mine blast holes be investigated.

RECOMMENDATIONS

It is recommended that expert to expert contacts be immediately developed between the BOM and EG&G Mound in the following areas:

- Energetic Materials - EXP AND F&E Groups, PRC
- Ceramics - Tuscaloosa Research Center
- Thermite welding and burning - EXP Group, PRC
- Metallurgy - Albany Research Center
- Ultrasonic non-destructive testing - Wire rope testing, MSHE, PRC

These contacts need not be elaborate efforts. They should be initiated with a call from the appropriate BOM expert to the appropriate EG&G Mound expert, after Dr. Sacks, Deputy Director - PRC has setup the interaction through Dr. Braun. Continued development of the relationship should be left in the hands of the two experts.

1

5165

John Murphy - P&C



EG&G MOUND APPLIED TECHNOLOGIES

P.O. BOX 3000 MIAMISBURG, OHIO 45343-0987 • TEL (513) 865-4020

January 12, 1990

PH

David R. Forshey
Associate Director - Research, WO
Bureau of Mines
2401 E. Street, N.W.
Washington, D.C. 20241

Dear Mr. Forshey:

In response to your letter dated December 19, 1989, EG&G Mound Applied Technologies would be pleased to cooperate in any way we can to enhance our nation's minerals industries through technology transfer.

Our Manager of Technology Transfer, Dr. Japnell D. Braun, should be the contact point within our organization for communication on this issue. She can be reached at (513)865-3829.

EG&G Mound, an integrated research, development and production facility is one of the 11 sites making up the nation's nuclear weapons complex, and some of the technologies required for the manufacture, surveillance and evaluation of components for nuclear weapons components may well have applicability in the minerals industries. If I can be of any further help to you, please let me know.

Sincerely,



Richard E. Vallée
Associate General Manager

REV:JDB:pg



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



March 12, 1990

Dr. Japnell D. Braun
Manager of Technology Transfer
EG&G Mound Applied Technologies
P.O. Box 3000
Miamisburg, Ohio 45343

Dear Dr. Braun:

Thank you for arranging my March 6, 1990 visit to EG&G Mound Applied Technologies. You are a very energetic and impressive individual. The tour of the materials analysis and ceramics facilities was quite informative. Mound has well developed scanning electron microscope and strength of materials testing capabilities that could be used by BOM personnel.

The round table discussion with the EG&G managers and technical personnel opened my eyes to the willingness of EG&G to help us in our mission. I feel Mound has much to offer the mining and minerals industry in the areas of energetic materials, ceramics, thermite welding and burning, metallurgy, and ultrasonic non-destructive testing.

I hope expert to expert contacts can be immediately developed between the BOM and EG&G Mound. These contacts need not be elaborate efforts. They should be initiated with a call from the appropriate BOM expert to the appropriate EG&G Mound expert, after Dr. Sacks, Deputy Director, Pittsburgh Research Center has setup the interaction through you. Continued development of the relationship should be left in the hands of the two experts.

Sincerely,

Alan A. Campoli
Mining Engineer

*cc R K Sacks
A A Campoli
PRC Files*

Appendix R

Oak Ridge Associated Universities (ORAU)

APPENDIX R

Oak Ridge Associated Universities
P.O. Box 117
Oak Ridge, TN 37831

Contact
Ms. Wanda Penland
Office of Information Services
(615) 576-3365

MISSION

Oak Ridge Associated Universities (ORAU), a consortium of 49 colleges and universities, serves as a link between DOE laboratories and the nation's colleges and universities. Programs place participants where their own interests can best be served and where their skills can best serve the nation's research and development efforts. ORAU's programs foster basic energy-related scientific research and applied technology and are designed to address manpower needs in those areas. Primary research and training areas are: basic nuclear physics, human resource development, medical and health sciences, and university programs.

FINDINGS

ORAU is a government-owned contractor-operated DOE laboratory. ORAU's 1989 budget is \$40 million of which 75 percent is DOE funding. The remaining funding comes from other Federal sources (22 percent) and the private sector (3 percent). A consortium of 49 colleges and universities form ORAU, which operates at eight locations in Oak Ridge, TN and an office in Washington, DC.

Ms. Wanda B. Penland, Director, Office of Communication Resources, hosted my April 5, 1990, visit to ORAU. The research at ORAU is performed by four divisions: Medical Sciences, Science/Engineering Education, Training and Management, and Energy/Environment Systems. The Energy/Environment Systems Division develops, analyzes, and evaluates policies and regulations affecting energy and environmental issues; carries out field assessments of hazardous materials contamination; develops techniques for resource protection and enhancement; and develops and implements energy systems application programs.

The Medical Sciences Division (MSD) conducts basic research and development in the area of nuclear medicine. MSD also investigates the medical benefits and costs to humans resulting from exposure to the by-products of energy-related technologies. The division carries out basic research; devises techniques to avoid, moderate or reverse negative health impacts; analyzes health risks; and provides information systems and management expertise to deal with the health-related impacts of technology.

Dr. Donna Cragle, Lead Epidemiologist, Center for Epidemiologic Research, MSD, discussed ORAU's research on radon risk analysis. This ORAU work was done for MSHA, as input for the radon in mines legislation. ORAU's epidemiologic researchers could help in the formation of health risk analysis programs for any mining and processing hazard, silicon dust, for example.

The Science/Engineering Education Division (SEED) seeks to increase the supply of scientists and engineers; broaden the participation of minorities, women, and the disabled in science and engineering careers; enhance teacher preparation and faculty development; improve science and engineering education; strengthen cooperation between the academic community and Federal laboratories; and provide technical assistance to Federal agencies and laboratories.

Dr. Richard W. Wieseuegel, Program Director, SEED, discussed the Fossil Energy Research Participation Program, which provides a variety of opportunities for educators, recent graduates, and students to conduct research and receive training in advanced fossil energy technologies. The programs are offered at the Pittsburgh Energy Technology Center, Morgantown Energy Technology Center, and our own Pittsburgh Research Center. This is another example of how the mining and mineral industries benefit from DOE research. Richard thinks academe should be a part of any BOM activities relative to DOE laboratories. He offered to make contacts with universities on this issue.

The Training and Management Systems Division (TMSD) develops and presents training programs for a wide range of clients. The work encompasses the design, delivery, and evaluation of training and management of training networks throughout the Federal and academic communities. TMSD serves as a broker for training expertise within the Federal system and between universities and the private sector.

Tina McKinley, TMSD staff, ORAU FLC representative, briefed me on the legislation that formalized the government laboratory technology transfer mechanism. She has sent me copies of the legislation and related FLC documentation. She feels that we must display an understanding of this legislation in our final report. A review of this information and my attendance at the Denver FLC meeting should provide for this.

RECOMMENDATIONS

ORAU is the DOE lead center for worker health risk assessment; they should be contacted by BOM personnel considering related research.

Ms. McKinley's suggestion, that our final report illustrate an understanding of technology transfer legislation, should be followed. I suggest a meeting with WO technology transfer staff be arranged, after the draft of our final report is finished. Mr. Ralston should be brought up to speed on our recommendations and conclusions prior to release of the report.

y. ...

A. Campoli

 Oak Ridge
Associated Universities Post Office Box 117
Oak Ridge, Tennessee 37831-0117

January 15, 1990

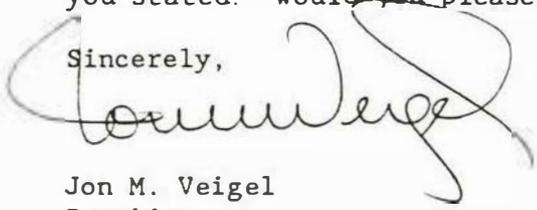
Mr. David R. Forshey
Associate Director, Research, WO
United States Department of the Interior
Bureau of Mines
2401 E Street, NW
Washington, DC 20241

Dear Mr. Forshey:

As you requested in your December 19, 1989 letter to me, I have designated Wanda Penland, ORAU's Technology Transfer Officer, to serve as our point of contact to facilitate effective communication between our organizations on mining technologies.

A copy of "U.S. Bureau of Mines Research" was not enclosed with your letter as you stated. Would you please forward a copy to Ms. Penland? *Sent 2/9/90*

Sincerely,



Jon M. Veigel
President

JMV:JAM:jm

c: Wanda Penland



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



April 26, 1990

Ms. Wanda Penland
Office of Information Services
Oak Ridge Associated Universities
P.O. Box 117
Oak Ridge, TN 37831

Dear Ms. Penland:

Thank you for hosting my April 5, 1990, visit to Oak Ridge Associated Universities. You displayed a great enthusiasm for ORAU. My visit was very informative due to the many ORAU personnel who were so generous with their time and expertise. Tina McKinley, Training and Management Division, was especially informative. Her experience in technology transfer and the Federal Laboratory Consortium was quite impressive. I am looking forward to reading the legislation that formalized the government laboratory technology transfer mechanism that she provided.

Thank you,

Alan A. Campoli
Mining Engineer

cc: AACampoli
HKSacks
Tina McKinley
PRC Files

GMC:AACampoli:mm:4/26/90:(412)892-6558

Appendix S

Pittsburgh Energy Technology Center (PETC)

APPENDIX S

Pittsburgh Energy Technology Center
P.O. Box 10940
Pittsburgh, PA 15236

Contact
Ms. Kay Downey
FTS 723-6029

MISSION

The Pittsburgh Energy Technology Center (PETC) is responsible for the technical and administrative management of a dozen lead mission research and development programs within the Office of Fossil Energy. In addition to the Pittsburgh facility, PETC has administrative responsibilities for the petroleum and natural gas R&D programs at the National Institute of Petroleum and Energy Resources through DOE's Bartlesville, OK, Project Office. In conjunction with these program responsibilities, PETC has established a National Clean Coal Technology Data Center where users may have access to government data bases on coal research in PETC's lead laboratory areas. PETC's responsibilities are grouped within the following areas: environmental concerns - coal preparation, advanced combustion, flue gas cleanup, and alternative fuels; energy conversion - magnetohydrodynamics, coal liquefaction, and advanced research in liquefaction; fundamental research - University Coal Research, solids transport, and direct utilization.

FINDINGS

Ms. Kay Downey met with me on March 30, 1990, we discussed the research and technology transfer efforts ongoing at PETC. PETC through cost sharing contracts encourages the private sector to deploy new fossil energy technology. This process brings PETC in close contact with the fossil fuel industry and the Bureau.

RECOMMENDATIONS

Do to the many working relationships between PETC personnel and the fossil fuel industry, no future action is warranted.



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRAN'S MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



April 6, 1990

Ms. Kay Downey
Pittsburgh Energy Technology Center
U.S. Department of Energy
P.O. Box 10940
Pittsburgh, PA 15236

Dear Ms. Downey:

Thank you for making time in your busy schedule to meet with me on March 30, 1990. You provided me with an excellent description of the Pittsburgh Energy Technology Center and its technology transfer program. Your patience was greatly appreciated. Please add me to your technology transfer mailing list.

Sincerely yours,

Alan A. Campoli
Mining Engineer

cc: - AACampoli
HKSacks
PRC Files

Appendix T

Princeton Plasma Physics Laboratory (PPPL)

APPENDIX T

Plasma Physics Laboratory
Princeton University
P. O. Box 451
Princeton, NJ 08543

Contact
Dr. Joseph File
Office of Technology Transfer
(609) 234-3009

MISSION

The Princeton Plasma Physics Laboratory (PPPL) conducts research in magnetic fusion energy using a Tokamak Fusion Test Reactor and associated experimental equipment. PPPL is a world leader in research and development aimed primarily at the utilization of magnetic fusion energy as a safe, economical, and environmentally acceptable method of generating electricity for the long term. Primary program area: magnetic fusion, with extensive research and development in neutral beam technology, remote handling of nuclear systems, plasma engineering, plasma diagnostics, and surface modification technology.

FINDINGS

Dr. Joseph File, Head Office of Technology Transfer, organized my March 15, 1990 visit to PPPL. Dr. File was trained as a mechanical engineer and has been involved in the design and operation all the major PPPL experiments, since PPPL opened approximately 30 years ago. His dedication to PPPL and energetic approach to technology transfer were very impressive.

Dr. Jack B. Joyce, Head Engineering Department, provided an overview of PPPL and fusion research. Funded by the DOE (\$90 million FY90) and operated by 1,000 employees of Princeton University, PPPL's ultimate research goal is the magnetic confinement of an ionized gas (plasma) composed of heavy isotopes of hydrogen (deuterium and tritium) at a density of 1/100,000 that of air at sea level, a temperature of 100 million degrees centigrade, and an energy confinement time of one second. These are the physical conditions required for the production of useful fusion energy in a power reactor.

As an intermediate step, PPPL's Tokamak Fusion Test Reactor (TFTR) has been designed to achieve energy break even, where the energy required to maintain critical plasma temperature equals the fusion power produced. They hope TFTR will achieve break even in a few years. Dr. Kenneth M. Young, Head TFTR Diagnostics, gave me an unexpected and very interesting hands on tour of the TFTR.

The next major research effort is the Compact Ignition Tokamak (CIT), planned to be the world's first fusion device capable of producing an ignited plasma. At ignition enough fusion power is released to maintain the plasma temperature without the need for auxiliary power input. Assuming funding at PPPL's recommended level and optimum scientific progress, a working fusion pilot power generation plant is still 30 years away.

After the plasma is heated by magnetic induction heating, it must be further heated by either neutral electron beam excitation or radio frequency (RF) energy to the required fusion temperature. Dr. Pat Colestock gave me an introduction to RF capabilities at PPPL. PPPL is one the world's leaders in RF research. There are three BOM centers that employ RF: they are the Reno Research Center - Microwave heating enhances ore processing; Tuscaloosa Research Center - Dielectric heating properties of minerals - Microwave induced plasma, tungsten carbide process; and Twin Cities Research Center - Microwave fracturing for in situ mining. These three centers should be informed of the willingness of PPPL to assist BOM researchers.

Peter Del Gandio, Supervisor Special Projects and Operational Safety, is organizing the use of a NOAH, Department of Commerce expert system for the eastern United States. The Computer Aided Management of Emergency Operations (CAMEO) program is an expert system developed to aid in fire fighting and hazardous material spill situations. He is very interested in helping the BOM tailor CAMEO for the mining and mineral industries and BOM facility preparedness. Perhaps this is an opportunity for PRC safety staff to develop this program and lead the other BOM centers in this area.

RECOMMENDATIONS

It is recommended that expert-to-expert contacts be immediately developed between the BOM and PPPL in the following areas:

Radio frequency energy - Reno, Tuscaloosa, and Twin Cities Research Centers
CAMEO - Safety Staff, PRC

The immediate contacts should be initiated with a call from the appropriate BOM expert to the appropriate BNL expert, after Dr. Ken Sacks, Deputy Research Director, PRC, has set up the interaction through Dr. File. Continued development of the relationship should be left in the hands of the two experts.

John Murphy -PPC

Princeton University PLASMA PHYSICS LABORATORY
JAMES FORRESTAL CAMPUS
P.O. BOX 451, PRINCETON, N.J. 08544

January 16, 1990

Mr. David R. Forshey ^{D.R.}
Associate Director, Research WO
U.S. Department of Interior
Bureau of Mines
2401 E Street, NW
Washington, D.C. 20241

Dear Mr. Forshey:

Dr. Harold Furth, Director of the Princeton Plasma Physics Laboratory has asked me to respond favorably to your letter of December 19, 1989. PPPL is pleased to cooperate in the Interior Department's effort to maximize technology transfer from the Federal Laboratories.

As Head of PPPL's Office of Technology Transfer (OTT), and representative to the Federal Laboratory Consortium (FLC), I will be your contact at PPPL. Please feel free to communicate with me at any time. I enclose my business card for your convenience.

Sincerely,

Joseph File
Dr. Joseph File
Head, Office of Technology Transfer

JF:mab

PHONE 609-243-3009
TELECOPIER 609-243-2749



JOSEPH FILE, Ph.D.
HEAD
OFFICE OF TECHNOLOGY TRANSFER

PRINCETON UNIVERSITY
PLASMA PHYSICS LABORATORY
P.O. BOX 451
PRINCETON, N.J. 08543



United States Department of the Interior



BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070

March 19, 1990

Dr. Joseph File
Office of Technology Transfer
Plasma Physics Laboratory
Princeton University
P. O. Box 451
Princeton, NJ 08543

Dear Dr. File:

Thank you for hosting my March 15, 1990 visit to the Princeton Plasma Physics Laboratory. Your past technical involvement in the design and operation all the major PPPL experiments gives you a truly unique perspective. Your dedication to PPPL and energetic approach to technology transfer were very impressive. My visit was very informative due to the many PPPL personnel who were so generous with their time and expertise.

The possibility of immediate expert-to-expert contacts in the areas of radio frequency energy and CAMEO expert systems should be considered. These PPPL to Bureau of Mines (BOM) contacts need not be elaborate efforts. They should be initiated with a call from the appropriate BOM personnel to the appropriate PPPL expert, after Dr. Ken Sacks, Deputy Research Director. Pittsburgh Research Center has setup the interaction through you. Continued development of the relationship should be left in the capable hands of two technical representatives.


Alan A. Campoli
Mining Engineer

cc: HKSacks
AACampoli ✓
PRC Files

Appendix U

Savannah River Company (SRL)

APPENDIX U

Westinghouse Savannah River Company
P.O. Box 616
Aiken, SC 29802

Contact
Mr. John C. Corey
(803) 725-3020

MISSION

The Savannah River Laboratory (SRL) provides development and technical assistance in all areas of nuclear reactor technology and the nuclear fuel cycle, including fuel fabrication, robotics technology, isotope production, reactor physics and engineering, fuel reprocessing, waste management, and environmental monitoring. Primary program areas are: nuclear materials production and defense waste management.

FINDINGS

Mr. Gerald Hooker hosted my April 3, 1990, visit to the Westinghouse Savannah River Company (WSRC), Aiken, SC. Mr. Hooker works for our contact in the technology transfer office. The WSRC technology transfer program is in its infancy. They have no printed descriptions of the facility or history of past commercialization of developments. This is due to their heavy involvement in nuclear material production for weapons.

WSRC is located on a 17-mile-diameter circle of land, employs 22,000 people, and has a total budget of \$1.4 billion a year. Their primary mission is the production of weapons grade plutonium and tridium, from three reactors (called K, L, and P). The reactor product is put through an elaborate separation facility to refine it to weapons grade. Research to support the primary mission is conducted at the Westinghouse Savannah River Laboratory (WSRL). WSRL reports to WSRC management and is funded at \$110 million a year. DOE is the sole source of funding for this government-owned and contractor (Westinghouse Corp.) operated facility.

The technology transfer effort centers on patent disclosure and licensing. WSRC personnel are encouraged to patent any idea they believe has commercial application. The majority of these patents relate to the weapons material production process. However, a few of these ideas and processes could relate to mining and mineral processing.

The WSRC has 30,000,000 gallons of concentrated nuclear waste stored on site. The Defense Waste Processing Facility is under construction to process this huge amount of liquid waste, at a cost of \$1.2 billion. The waste will be chemically treated and encapsulated in a glass material. The design of this process was done at WSRC, by the WSRL. In the process, capabilities in chemical and biological environmental engineering have been developed.

WSRL personnel have proven that life exists at depth into the earth. Many hundreds of new microbe types have been isolated in this process. Many pharmaceutical and waste remediation uses for these new microbes are predicted. Methods to foster the growth of selected microbes in situ have

also been developed. Algae that collect selective pollutants from lakes have been developed. These selected developments came from the chemical process and environmental technology group.

An interesting idea for ground water remediation has been patented. Horizontal boreholes are drilled directly below the water table, from the surface. Water and treatment chemicals are pumped into the well under high pressure to treat the ground water in situ.

RECOMMENDATIONS

The WSRC is a single program, defense dedicated DOE facility. It is just now entering into the technology transfer for commercialization area. Facilities such as these should not be ignored in future efforts.



Westinghouse
Savannah River Company

John Knight - PRC

P.O. Box 616
Aiken, SC 29802

SRL-PI-90-0014

January 12, 1990

Mr. D. R. Farshey ^{DM}
Associate Director - Research, WO
United States Department of the Interior
Bureau of Mines
2401 E Street, NW
Washington, D.C. 20204

Dear Mr. Farshey:

Savannah River Laboratory Contact for Bureau of Mines

Ref: Letter, D. R. Farshey to R. T. Begley, 12/19/89

I have reviewed your request for a contact point within the Savannah River Laboratory for the Bureau of Mines and feel Mr. John C. Corey can provide any assistance you may require. Please feel free to contact Mr. Corey at (803) 725-3020.

Yours truly,

R. T. Begley
Vice President and Director
Savannah River Laboratory

JAC:dll



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



April 26, 1990

Mr. John C. Corey
Westinghouse Savannah River Company
P.O. Box 616
Aiken, SC 29802

Dear Mr. Corey:

My thanks to Gerald Hooker for hosting my April 3, 1990, visit to the Westinghouse Savannah River Company. He displayed a great enthusiasm for WSRC and was very knowledgeable and professional.

Thank you,

Alan A. Campoli
Mining Engineer

Appendix V

Solar Energy Research Institute (SERI)

APPENDIX V

Solar Energy Research Institute
1617 Cole Boulevard
Golden, CO 80401

Contact
No representative

MISSION

The Solar Energy Research Institute (SERI) conducts basic and applied research in the physical, chemical, biological, and engineering sciences pertinent to solar and renewable energy resources. Research activities are carried out in three divisions: Solar Electric Division, Solar Fuels Division, and Solar Heat Division. Primary program area: solar and renewable energy.

FINDINGS

Dr. Gene Mannella, Director, SERI, did not appoint a representative.

RECOMMENDATIONS

SERI should not be included in any future BOM "focal point" efforts.

1/12/90 John Humphrey - PR

A Division of Midwest Research Institute



January 12, 1990

Mr. David R. Forshey
Associate Director -- Research, WO
United States Department of the Interior
Bureau of Mines
2401 E Street, N.W.
Washington, Dc 20241

Dear Mr. Forshey:

Thank you for your letter of December 19, 1989, informing us of the meeting last March in Pittsburgh and requesting a contact point at SERI for Mr. Campoli. SERI is a somewhat small research institute focused primarily on renewable energy technology and on energy efficiency. Our involvement in technology relevant to the minerals industry is minimal, at best. While we support and encourage the general theme of stronger ties between the private sector and industry, I don't think we have a role in the study you have been tasked to perform. Accordingly, while I wish you success in carrying out this mandate, I think it appropriate for SERI not to be included in this survey.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Gene G. Mannella".
Gene G. Mannella
Managing Director

U:forshey,ltr ks

Appendix W

Stanford Linear Accelerator Center (SLAC)

APPENDIX W

Stanford Linear Accelerator Center
P.O. Box 4349
Stanford, CA 94309

Contact
Mr. Eugene B. Rickansrud
Associate Director Business Services
(415) 926-2216

MISSION

The Stanford Linear Accelerator Center (SLAC) carries out experimental and theoretical research in high-energy physics and developmental work in new techniques for particle acceleration and experimental instrumentation. SLAC's main research instrument is a two-mile-long linear electron accelerator, the largest in the world, the SLAC Linear Collider. Primary program area is high-energy physics.

FINDINGS

SLAC is operated by Stanford University for the DOE. Annual funding and staffing level for SLAC is approximately \$90 million and 1,300.

Mr. Rickansrud feels that little can be gained by the mining and mineral industries from the high-energy physics research conducted at SLAC.

RECOMMENDATIONS

SLAC should not be the subject of any future BOM "focal point" efforts.



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



May 31, 1990

Mr. Eugene B. Rickansrud
Associate Director Business Services
Stanford Linear Accelerator Center
P.O. Box 4349
Stanford, CA 94309

Dear Mr. Rickansrud:

I appreciate your advice, relative to the Bureau of Mines' effort to assist in the transfer of Department of Energy technology to the mining and mineral industries. I agree with you that SLAC high-energy physics research has little to add to this effort.

Thank you,

Alan A. Campoli
Mining Engineer

cc: HKSacks
AACampoli
PRC Files

GMC:AACampoli:mm:5/31/90:(412)892-6558

Appendix X

Westinghouse Hanford Company

APPENDIX X

Westinghouse Hanford Company
P.O. Box 1970 L5-55
Richland, WA 99352

Contact
Mr. Fred R. Reich
(509) 376-4063

MISSION

Westinghouse Hanford Company (WHC) manages the advanced reactor engineering and development, defense production, defense waste, and site support services programs and facilities for the DOE's Hanford Site. WHC operates the Fast Flux Test Facility (FFTF), a unique sodium-cooled reactor providing full reactor-scale irradiation test conditions for advanced fuels, materials, and components. The FFTF is fully supported by other hot cell and material analysis capabilities. The Fuels and Materials Evaluation Facility (FMEF) is a nuclear material handling and processing facility currently targeted to house and support a plutonium-238 production line. The FMEF will be the fabrication and reprocessing base for the FFTF fuel supply.

FINDINGS

Mr. Fred R. Reich, WHC, Office of Technology Transfer, hosted my April 19, 1990, visit to the WHC. The Hanford Site is funded by the DOE, \$1 billion in FY90, through Westinghouse and Battelle (BPNL). A total of 15,000 people are employed at the Hanford Site. The WHC's FY90 funding is approximately \$700 million.

WHC research is performed in: nuclear science; materials and chemical science; earth and environmental science; life science; hazardous and radioactive waste treatment; computer modeling of complex system; systems engineering; and technology forecasting and application.

The world's most advanced, versatile test reactor is located at Hanford, and operated by WHC. The unique capabilities of the Fast Flux Test Reactor (FFTR) are employed in nuclear materials testing, fusion tests, space materials tests, and sodium coolant development for fission reactors. The FFTR is Hanford's big science centerpiece.

Steven J. Phillips, Geotechnical Engineering, Soil Physics Group, Environmental Engineering and Technology Division gave a presentation on grouting of liquid nuclear waste with zeolite mixtures. Methodology to grout isolate existing nuclear slurry waste cribs, buried wooden containment structures, was discussed. Boreholes are drilled around the cribs and grout is pumped in to fill voids, and thus limit groundwater exposure. Much of the technology employed is mining related. The drills and expanding grout mixtures would be very familiar to PRC Ground and Methane Control personnel. Mr. Phillips would very much like to exchange geotechnology professionals between the BOM and WHC, to facilitate hands-on technology transfer. He would also like to consider the addition of BOM experts to the WHC technical peer review procedure.

Don J. Moak, Manager, Ground Water Well Services Group, Environmental Engineering and Technology Division, gave a presentation on cable drilling for nuclear waste site monitoring. Don was also interested in personnel exchange for technology transfer. He requested to be added to the BOM Technology News mailing list. I have taken care of this, and I think we should do the same for all of the DOE people I have met.

Mr. Roger N. Johnson, Development Division, showed me a process for applying chromium carbide coatings to steel. Electro-spark deposition is a pulsed-arc micro-welding process using short-duration, high-current pulses to deposit material on a metallic substrate. A fused, metallurgically bonded coating can be applied with such a low heat input that the bulk substrate materials remains at near ambient temperatures. The surface provides for much improved resistance to frictional wear and chemical corrosion. The process does not require a super-clean environment and can be performed in the field. Wear tests, with materials that have fines associated with them, have shown the fines coat the metallic surface and lubricate the flow of material. This could be a wonderful development for coal bins, belt stage loaders, crushers, etc. Roger is very interested in talking to mining equipment manufacturers on this issue.

Jim Thielges, Development Division, gave a tour of the WHC metal welding facility. The laser beam, electron beam, induction braze, an automatic gas tungsten welding facilities were quite impressive. They create what they need for the FFTR in house, and could be a good source for BOM metallurgical personnel in the high-tech welding fields.

Mr. Wayne Burk, Mechanical Engineer, and Mr. C. P. Schroeder, Electrical Engineer, of the Engineering Division, gave me a tour of the WHC Engineering Laboratory. The laboratory designs and builds special instrumentation equipment that is required for the Hanford Site. Much of what they build is to monitor and ventilate airborne nuclear contaminates. I saw many ventilation test chambers very similar to PRC Dust Control and Ventilation devices. DC&V personnel could have prevented the reinvention of many a wheel in this work.

RECOMMENDATIONS

The WHC research involves many of the same technologies employed by BOM researchers. I was exposed to a very small segment of the WHC. However, BOM experts in the areas of: rock drilling, expansion grouting, electro-spark deposition of hard steel coatings, and ventilation should be identified to Mr. Reich, by Dr. H. Kenneth Sacks, Deputy Director, PRC.



Westinghouse
Hanford Company

John Murphy PRC

P.O. Box 1970 Richland, WA 99352

January 17, 1990

9000290B RI

or
David R. Forshey
Associate Director--Research, W0
Bureau of Mines
2401 E. Street, N.W.
Washington, D.C. 20241

Dear Mr. Forshey:

TECHNOLOGY TRANSFER

Reference: Letter, D. R. Forshey to J. E. Nolan, "Efforts to Engender a Technical Relationship Between the National Laboratories and the Minerals Industry in Order to Enhance Our Nation's Minerals Industries Through Technology Transfer," dated December 19, 1989.

The reference letter requested a contact point within Westinghouse Hanford Company to facilitate effective communication on technology transfer. F. R. (Fred) Reich of my staff will fulfill this request. His mailing address and phone number are provided below:

Westinghouse Hanford Company
P.O. Box 1970 L5-55
Richland, WA 99352
509-376-4063 (FTS 444-4063)

Very truly yours,

J. J. Holmes, Manager
Development

jcr

cc: A. A. Compoli



United States Department of the Interior

BUREAU OF MINES

PITTSBURGH RESEARCH CENTER
COCHRANS MILL ROAD
POST OFFICE BOX 18070
PITTSBURGH, PENNSYLVANIA 15236-0070



April 26, 1990

Dr. John E. Nolan
Director
Westinghouse Hanford Company
P.O. Box 1970
Richland, WA 99352

Dear Dr. Nolan:

Mr. Fred R. Reich organized and hosted my April 19, 1990, visit to the Westinghouse Hanford Company. His knowledge of, and dedication to, WHC were quite impressive. WHC research involves many of the same technologies employed by Bureau of Mines researchers. I was exposed to a very small segment of your facility. However, BOM and WHC cooperation in: rock drilling, expansion grouting, electro-spark deposition of hard steel coatings, and ventilation technologies could enrich both organizations. Dr. H. Kenneth Sacks, Deputy Director, Pittsburgh Research Center, will contact Fred relative to these issues.

Sincerely yours,

Alan A. Campoli
Mining Engineer